# Device SEE Susceptibility Update: 1996-1998 J.R. Coss, T.F. Miyahira, G.M. Swift Jet Propulsion Laboratory California Institute of Technology Pasadena, California

### Abstract

This eighth Compendium continues the previous work of Nichols, et al, on single event effects (SEE) first published in 1985. Because the Compendium has grown so voluminous, this update only presents data not published in previous compendia.

### I. Introduction

SEE test programs have continued for several years at the Jet Propulsion Laboratory (JPL), Aerospace Corporation, (ARSP) Goddard Space Flight Center (GSFC), and the European and French Space Agencies (ESA and CNES) to assess device susceptibility to heavy ion and/or proton environments. More recently, organizations such as Space Electronics, Inc (SEI), Matra-Marconi Space (MMS) and Saab have been making significant contributions in this research area. Seven compendia have been published since 1985 in the IEEE Transactions on Nuclear Science [1, 2, 3, 4] and the Radiation Effects Data Workshop Records [5, 6, 7].

## II. Testing Approaches

The testing approaches used by all these organizations, while similar, are not identical. Additionally, all these techniques are constantly evolving and moving more and more to computer-control. In general, the testing procedures follow those outlined in the ASTM F1.11 or JEDEC 13.4 documents [10, 11] on single event testing.

# III. Data Organization and Scope

This paper summarizes single event upset (SEU) and latchup (SEL) data from 1996 to 1998 from numerous sources. Some additional data from earlier years has come to

light and is also included. Single event gate rupture (SEGR) or burnout (SEB) of power transistors is not included, but has previously been presented in the Radiation Effects Data Workshop Records [12, 13, 14]. There is also a limited set of published SEE data using neutrons [15, 16], but because of the paucity of data, this is not included here.

The data reported in the tables is substantially abbreviated, generally including only thresholds and saturation cross sections, and ignores any statistical features, i.e., the data has been excerpted directly from the referenced reports. Because of different definitions of what constitutes threshold, the user would be advised to review the original reference. Although we have endeavored to provide the user with data source references, because of processing changes it is always advisable to consider a test on the flight lot to be used, particularly if the Compendium shows that a device may be marginal for a given mission.

Previous Compendia versions presented a mixture of heavy ion data, with a few entries on proton testing. Because of the significant amount of work performed in the past few years with proton accelerators, this data has been separated out into separate tables. Table 1 shows data from heavy ion testing while Tables 2 and 3 show proton data. The Compendium layout from previous years has also been somewhat modified to make it easier to use. In addition to dividing heavy ion and proton data into separate tables, other significant changes were removal of latchup information from the remarks and placing it into separate columns, thus providing more comprehensive data sets. These changes allow the user to quickly scan a row and, where it exists, get both upset and latchup phenomena data.

The research described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronauties and Space Administration.

4													
Org	• Device	Function	Technology	ž	Effective	Device		L.	<del> </del>	<b>—</b>	<b>-</b>		
	В				Threshold	(cm²)	Tested	Asction 16st		ox : "OT	Xsection Fac.	Remarks	
			and the second s		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				2	5)	(cm_)		26-Apr-99
GSFC	C 1840RP	16-channel analog MUX		SEI	>110			<i>L66</i> 61	<i>L</i>		BNL	O'Bryan, et al, 98IEEE Wrkshp Rec., pg 39.	
SEI	65CU2	ASIC process test	CMOS Fab 1	SEI	>23<27	1.SE-04		Feb-97 Mar-97	74.		BNI.	Layton, ct al, 981EEE Writshp Rec., pg 170.	
GSPC	OV AD570	Successive Approximation	смоѕ	ΙQ	7	3.06-04		9661		>52.5	Z		
즉	HI1276	Flush	ECL (Bipolar)	HAR			+	Mar-97	+	, P	2	`T_	
SEI	MP7684	20 Mcgasamples/sec	СМОЅ	EXE	41.4	6.0E-02	-	Capi	+-	98 to	1		
본	TMC1175C3V20	Video Flash	Submicron CMOS	RAY			-	%-m/		26.6 25 1.1E-04	BNI BNI	Layton, et al, 981EEE Wrkshp Rec., pg 170.	
FCA	AD7803CO					l	╂		▐		-8		
		Serial 3.3 µs conversion time	LC'MOS	₹	4	~2.5E-05		1997	× ×		CAC	Boc, et al, 981EEE Wrkshp Rec., pg 58.	
CSFC	CS5012	Self-calib., par/scrial interface	смоѕ	CRY	3.5 TO 4.8			Mar-97	11	_	-	LaBel, EEE Links, Vol. 3, No. 1, Mar 97	
Ä	AD9240	10 MSPS Binary parallel out	СМОЅ	ĪQΫ				7X61	ř	70 30 7			
되	AD9243	3 MSPS Binary parallel out	СМОЅ	٦			+		+	+	-		
Z,	ADS-946-2			DAT TAG			+	<u>86</u>	+-	-			
							_	1991		4.05-06	Je TAM	Miyahira, preliminary JPL internal report.	
GSPC	7805LPRP		смох	SEI	<1.45			1661	-11.4	4.	BNL	O'Bryan, et al 981EEE Writatio Rec. no 39 111 nontractions constituted to	And the mineral section of the
SE	7809LRP	¥	CMOS	BUB	<b>8</b> 2	S.0E-0S	-	Mar-97	6.61	3.0E-05	Ž	_	COLUMN CHI - OR.
EŠ	AD676AD	Parallel sucessive approx., 10 µs conv. time.	Hybrid, BiMOS II	ē	-1.8	>5.0E-05	+	7861	+	-			
Pag.	AD677	100 KSPS. Serial output	Hybrid; CMOS & BIMOS II	ī	3.4		-	Dec-90	-	-		and the state of t	M lingering errors recorded.
ESA	АД7884АQ	Two pass flash, 5.3 s conversion lime	LC'MOS	ī	-2	2.5E-03	-	1991	₹	_	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	By et al ONIEGE WAShe by	
GSPC	АДУ76	parallel, internal 2.5 V ref.	BICMOS	ā	<3.38		-	7661	+-	-	Na Line	O'Bran et al 981FFF Writch Be.	
म्	AD9260	Parallel, sigma-delta	CMOS	ΙQ			-	795	+-	2.05.08	+	Caryan, or a yource without hour, pg 59, LAC 9/2	
SEI	ADS7809	pwr	CMOS	<u> </u>	-	30.00	-		+	+	-	Device fauce after second facchup.	
룟	ADS-937	Parallel mitters than comme		3	+	7.10C-03	-	Mar-97	4.6	3.0E-05	S BNL	Layton, et al, 98IEEE Writshp Rec., pg 170. DAC 7550 & 9649.	50 & 9649.
			D D (hybrid)	DAT				7661	7.7	2.0E-04	TAM	Miyahira, preliminary JPL inemal report. All upacts from gase array chip.	from gate array chip.
ष्ट्रं	AD7714-3	3.3 V C	CMOS/epi	ΙQV				76-unf	\$	2.08-05	SBNL	LU rate (GCR) = 1.5E-04/yr.	
							l			-	-		

TABLE 1 Heavy Ion SEE Testing - 1996 to 1998

O Tes	• Device	Function	Technology	Ž	Effective SELL FT.	Device		L.	-	h	<u> </u>		
ž	And the second s	The state of the s			Threshold	(cm²)	Tested	ASSCHOOL ICSI (µm²) Date		LU <sub>lh</sub> Xso (cr	Xsection 1	į į	Remarks
GSFC	C DAC&SKN	Octal, scrial input	Bipolar	ΙQ	×80			Max-97					Jb Apr 99
GSRC	C MX7847TQ	Dual, parallel input	смоз	МХМ	-10			7661	-	\$1.4	<b>-   </b>	i i	Cancer, Life Lines, VOI. 5, No. 1, Mar 97, pg 5. D/C 9715
OSPC	SP9380			SIP	1.45 to 3.4			200		22 52			o styat, et at vollege with the c., pg 39.
GSRC	7804		Hobeid				╁			3		n n	Label, et al. YoleEEF Wrkshp Rec., pg. 19. Catastruphic Latchup.
GSPC	5690R-D15	Dual output. +15 V		N I	26.6	<1.0E-07		<u>78</u>		-	<b>A</b>		OBryan, et al 98 IEEE Wrkahp Rec., pg 39.
GSPC	AHF2812	Single output, 12 V	Hybrid	VQV	<37 (drop-		+	200			-	$\neg$	condition # LET = 22.6.  OBryan, et al 98 IEEE Writchn Received 10.11
GSPC	ASAZEUSSICH	Single output, +5 V	Hybrid	<b>V</b> QV	~14 (drop-	-4.0E-05	+-	200		-	20 7		© 50%-83% leads.  OBytan, et al. 98 IEEE Writchn Received 10.
GSRC	ATW2805S	Single output, +5 V	Hybrid	Ą	c37 (drop-		+	28	+		ā   ā		© 0% load; <20% w/180 ohm internal resistor; 20% × 20% w/2 kohm internal resistor; OBryan, et al 98 IEEE Wirksho Roc. no 30 - 10 nos drown was as 150 - 20.
GSPC	ICL7662MTV-4	Voltage Converter		MXM	59.7		-	-	9	-	ā		@ 70%><83% loads.
GSPC	MCH2805S	Single output, +5 V	Hybrid	Ē	700		-	-		-	ā a		♥ Vcc = 15 V · higher Vcc abows no errors.
GSFC	MD12680	DC/DC Puwer Convener	Hybrid (proprietary mod)	MDI	8		-		-		ă á		LABCI, CI AI, YOUEEE WITCH RCC., pg 19. No SEEs @ LET = 100.
AKSP	SMJ320C50GFAM50	Fixed point - SARAM	CMOS, 0.7 µm feature, 6.5 µm epi.	χĘ	3	1.06-02	╂	Cool	╂				gains a such our required power cycling
ARSP	SMJ320C50GFAMS0	Fixed paint - DARAM	CMOS, 0.7 µm feature, 6.5 µm epi.	X	9	3.0E-03	+	799	8 9	1			Crain, et al. 98 IEEE Writshp Roc., pg 51. D/C 9711B. Lockup errors begin @ LET = 15
ARSP	SMJ320CS(GFAMS)	Fixed point - PLU, ALU	CMOS, 0.7 µm feature, 6.5 µm epi.	ΤΙX	\$	1.0E-03		<u> </u>	+			$\neg$	Crain, et al. 98IEEE Writishp Rec., pg 51. D/C 9711B. Lockup creus begin @ LET = 15.
ARSP	SMJ32UCSKGFAMSU	Fixed point - NOP	CMOS, 0.7 µm feature, 6.5 µm epi.	Χ̈́L	2	2.0E-04	-	1997	+	-	nCB		Crain, et al., 901EEE Writish Rec., pg 51. DIC 9711B. Lockup errors begin @ LET = 15 Crain, et al., 981EEE Writish Rec., pg 51. DIC 9711B. Lockup errors begin @ LET = 15
ESA	ADSP-21020KG-133	FPU	CMOS	īq	7	2.0E-03	╂	Ž	╂		╋	_	
ESA	ADSP-21020KG-120	FPU	смоз	ā	\$	2.0E-03	-	3	2 3	2.0E-02	E EN		Harbue-Sorenken, et al. RADECS97 Data Workshop, pg 97. DrC 9623, Rev 3 die.
ESA	ADSP-21020KG-80	FPU	CMOS	Ę	~	2.0E-03	-	35	12	+-	+		Hance-Socialisti, et al. KALDELSSF Data Workshop, pg 97. DAC 9426921159502, Rev 1.
ARSP	SMJ32kC30GB	NOP, Cuche, ALU	CMOS (V.5.3), 6.5 µm epi, min 1	χ̈́Ł	-	2.0E-04	-	35	7	+-		_	Insuce Sortiagen, et al. KALDEL 397 Data Workshop, pg 97. DVC 9211/9528, Rev 1.
ARSP	SMJ320C30GB	General Register	um cpi. min	¥	6	7.0E-04	-	3	5		3   5		LIBB., CI M. VBIEEEE WIKAHP Roc., pg 51. D/C 9543. Snapback also observed.
ARSP	SMJ320C40HFM-40	ON	5.5 µm epi,	ΧŢ	-	1.0E-05	+-	35	₹ %				Crain, et al. 98IEEE Writishp Rec., pg 51. D/C 9943. Snapback also observed
ARSP	SMJ320C40HFM-40	Cache	um epi,	Ϋ́	3	3.0E-05	+-	56	×	+	3 2		Chair, or all youther within Roc., pg 31. D/C 9546A. Snapback also observed.
ARSP	SMJ320C40HFM-40	OTV	ım epi,	¥	8	2.0E-05	+	3	7	-	3   1	$\overline{}$	Crain, et al. 98 EEEE Writing Rec., pg 51. DrC 9546A. Stapback also observed.
				-	1		4	166	ž		<b>8</b> 2		Crain, et al, 981EEE Writzhp Rec., pg 51. DVC 9546A. Snapbach also ubserved

TABLE 1 Heavy Ion SEE Testing - 1996 to 1998

SEU LETT** Xection Bits  Threshold (cm³) Tested  5 2.0E-0.3  5 2.0E-0.3  10 10 10  10 20  8 8  21 5 5  5 5  20 6 10 8  8 8  21 6 10 8  8 8  21 7 8 8  8 8  21 8 8  8 8  21 8 8  8 8  21 8 8  8 8							
MADD 6 parts   CMOS 50C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   5 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   25 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   25 7.0E-0.5   TOROS 20C 21 22, 6.5 Jan epi,   TIX   27 7.1   TOROS 20C 21 22, 6.5 Jan epi,   TOROS 20C 21 22, 6	SEU LET**   Xacction			- T-	- <del>~</del> -	 Fr	Remarks
MAM	( ma) promoner	(mm)	4	╁	<b>.</b> E5	╂	
MAM	<u> </u>	-	8	<del>2</del>	$\downarrow$	SO	Crain, et al, 98IEEE Wrtshp Rec., pg 51. DrC 9546A. Snapback also observed
4K x 9         CMOS         MTA         37.1           4K x 9         SCMOSépi RT         MTA         37.1           50k Gaie reprogrammable PLA         CMOS         (10 6 µm)         GTF           9000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         10           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         28           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         28           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         5           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         20           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         5           8000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         30           10000 equiv. 2-input gates         CMOS (10 6 µm)         ACT         30           10000 equiv. 2-input gates         CMOS (20 6 µm)         ACT         30           10000 equiv. 2-input gates         CMOS (20 6 µm)         ACT         20           10000 equiv. 2-input gates         CMOS (20 6 µm)         ACT         20 30           10000 equiv. 2-input gates         CMOS (20 6 µm)         ACT         20 30           10000 equiv. 2-input gates	x 5		7661	, X		UCB	Crain, et al, 98IEEE Writshp Rec., pg 51. D/C 9546A. Snaphark also observed
9000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         10.0           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         10           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         10           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         28           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         5           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         5           8000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         5           100000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         5           100000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         20           100000 equiv. 2-input gates         CMOS (10.6 µm).         ACT         20           100000 equiv. 2-input gates         CMOS (20.6 µm).         ACT         20           100000 equiv. 2-input gates         CMOS (20.6 µm).         ACT         20           100000 equiv. 2-input gates         CMOS (20.6 µm).         ACT         20           100000 equiv. 2-input gates         CMOS (20.6 µm).         ACT         20           14000 gates         CMOS (20.6 µm).         ACT         20 <t< td=""><td>&lt;</td><td></td><td>1997</td><td></td><td></td><td>BNL</td><td>OBryan, et al., 98IEEE Writshp Rec., pg 39. D/C 9636. LETth - 3 (byte errurs); - 8 (control errurs); - 35 (mude channe)</td></t<>	<		1997			BNL	OBryan, et al., 98IEEE Writshp Rec., pg 39. D/C 9636. LETth - 3 (byte errurs); - 8 (control errurs); - 35 (mude channe)
SMR Clate reprogrammable PLA         CMOS         CMOS         ACT         100           90000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         10           80000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         28           80000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         28           80000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         5           80000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         5           80000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           100000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           60000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           100000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           60000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           10000 equiv. 2-input gates         CMOS (0.6 jum).         ACT         20           14000 gates         CMOS (0.6 jum).         ACT         20           14000 gates         CMOS, 3200DX family         ACT         30           14000 gates         CMOS, 3200DX family         ACT         5	<		961	7.2		BNI	LaBel, et al, 971EEE Writahp Rec., pg 14.
9000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         10           8000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         10           8000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         28           8000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         5           8000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         5           8000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         20           6000 oquiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 oquiv. 2-input gates         CMOS?opi?         ACT         20           6000 oquiv. 2-input gates         CMOS?opi?         ACT         21           14000 gates         CMOS.32000X family         ACT         20           14000 gates         CMOS.32000X family         ACT         30           14000 gates         CMOS.32000X family         ACT         3           14000 gates         CMOS.32000X family         ACT         5           14000 gates         CMOS.32000X family </td <td>GTF</td> <td></td> <td>Jan-97 Oct-97</td> <td>7.7 to 12</td> <td>3.06-02</td> <td>C UCB</td> <td>Layton, et al, 981EEE Wittahp Rec., pg 170.</td>	GTF		Jan-97 Oct-97	7.7 to 12	3.06-02	C UCB	Layton, et al, 981EEE Wittahp Rec., pg 170.
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8000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         28           8000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         5           8000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 equiv. 2-input gates         CMOS/epi?         ACT         21           6000 equiv. 2-input gates         CMOS/epi?         ACT         21           6000 equiv. 2-input gates         CMOS/epi?         ACT         21           6000 equiv. 2-input gates         CMOS/epi?         ACT         21           14000 gates         CMOS/api (1.0 µm featire size)         ACT         25 to 30           14000 gates         CMOS, 3200DX family         ACT         20           14000 gates         CMOS, 3200DX family         ACT         30           14000 gates         CMOS, 3200DX family         ACT         5           14000 gates         CMOS, 3200DX family         ACT         5		2.0E-07	7			CAC	Matteon, et al. SAAB Doc. SE/REP/0078/K, 10/97. D/C 9709. UO-module errors.
8000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         5           8000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         5           10000 equiv. 2-input gates         CMOS (0.6 µm).         ACT         20           10000 equiv. 2-input gates         COS/ept?         ACT         21           6000 equiv. 2-input gates         CMOS?ept (1.0 µm featire size)         ACT         21           6000 equiv. 2-input gates         CMOS?ept (1.0 µm featire size)         ACT         21           6000 equiv. 2-input gates         CMOS?axuDX family         ACT         20           14000 gates         CMOS,3200DX family         ACT         20           14000 gates         CMOS,3200DX family         ACT         30           14000 gates         CMOS,3200DX family         ACT         5           14000 gates         CMOS,3200DX family         ACT         5		8.0E-07	1997	<u> </u>	ļ 	CAC	Matteon, et al, SAAB Duc. SEREPROTIST, 1097. DIC 9709. C-module emus.
MODO equiv. 2-input gates		3.SE-06	2661 9		ļ	CAC	Matison, et al. SAAB Doc. SE/REP/0078/K, 10/97. DVC 9709. S-module errors.
BUXD equity. 2-input gates         COS/epi?         ACT         20           10000 equity. 2-input gates         COS/epi?         ACT         21           60000 equity. 2-input gates         CMOS?epi (1.0 jam featire sizz)         ACT         21           60000 equity. 2-input gates         CMOS?epi (1.0 jam featire sizz)         ACT         25 to 30           14000 gates         CMOS.3200DX family         ACT         20           14000 gates         CMOS.3200DX family         ACT         20           14000 gates         CMOS.3200DX family         ACT         30           14000 gates         CMOS.3200DX family         ACT         5           14000 gates         CMOS.3200DX family         ACT         5		2.5E-06	7661	_		CAC	Matton, et al, SAAB Doc. SEREPROTAN, 1097. DIC 9709. VO-module errors.
10000 equiv. 2-input gates		2.0E-06	7661			CXC	Matteon, et al, SAAB Doc. SE/REPAUTBY, 1097. DIC 9709. C-module errors.
10000 equiv. 2-input gates			1996	_		N. N.	LaBel, et al, 97 IEEE Writahp Rec., pg 14. S. & UO module errors.
60000 equity. 2-input gates         CMOS?epi (1.0 µm featire size)         ACT         6 to 8           60000 equity. 2-input gates         CMOS?epi (1.0 µm featire size)         ACT         25 to 30           14000 gates         CMOS, 3200DX family         ACT         10           14000 gates         CMOS, 3200DX family         ACT         20           14000 gates         CMOS, 3200DX family         ACT         30           14000 gates         CMOS, 3200DX family         ACT         5           14000 gates         CMOS, 3200DX family         ACT         5           14000 gates         CMOS, 3200DX family         ACT         5		-	<u>8</u>			BNL	LaBei, et al, 97IEEE Writshp Rec., pg 14. C.module errors.
6000 equiv. 2-input gates	6 to		1996	-		BNL	LaBel, et al, 97IEEE Writchp Rec., pg 14. S. & UO-module errurs.
14000 gates         CMOS, 3200DX family         ACT         10           14000 gates         CMOS, 3200DX family         ACT         10           14000 gates         CMOS, 3200DX family         ACT         20           14000 gates         CMOS, 3200DX family         ACT         30           14000 gates         CMOS, 3200DX family         ACT         5           14000 gates         CMOS, 3200DX family         ACT         5			966			BNL	LaBel, et al. 97IEEE Writshp Rec., pg 14. C-module errors.
14000 gates	ACT		7961	\$7×		BNL	Katz, EEE Links, Vol. 3, No. 3, pg 16, Sep 1997.
14000 gates		2.0E-06	9661	2 2		CAC	Mattson, et al, SAAB Doc. SEREPROTIBIK, 1097. DIC 9703. S-module errora.
14000 gates		2.0E-06	<u>86</u>	710		CAC	Malison, et al, SAAB Doc. SERREPNOTSIK, 1097. DIC 9703. I/O-module errors.
14000 gates		8.0E-07	<u>86</u>	2110		C.S.	Matison, et al. SAAB Doc. SE/REP/1078/K, 1097. DIC 9703. C-module errors.
14000 gates CMOS, 3200DX family ACT 5		3.0E-06	<u>3</u>	V 110		CAC	Malison, et al, SAAB Doc. SE/REP/10/78/K, 10/97. D/C 9703. S-module errus.
MAXIN pages		2.5E-06	35	710		CAC	Matteon, et al, SAAB Dox, SE/REPAUGTSK, 10977, DVC 9703. I/O-module errus.
Citical Second Second Act 13	уст 15	2.0E-06	9661	9 7		c <sub>3</sub>	Matteon, et al, SAAB Due, SEREPROTAUK, 1097. DIC 9703. C-mudule enux.
A32200DX 20000 gates CMOS, 3200DX family ACT	ACT		7661	=	1.5E-05	BNI	Katz, EEE Links, Vol. 3, No. 3, pg 16, Sep 1997. No saturation @ LET = 52.
CLAy-31 3134 equiv. Gales RAM-based GaAs NSC 5				*		BNI	LaBel, et al, 97 IEEE Writshp Rec., pg 14. Data errors.

TABLE 1 Heavy Ion SEE Testing - 1996 to 1998

12				-			f			İ		Ī	
o de	Device	Function	Technology	ME	SEU LET**	- ×	Bits	Bit Xsection	Test —	EG.	LU Xection	E.	Remarks
1				1	Threshold	(cm <sup>2</sup> )	Tested	(mm <sup>2</sup> )	D BE	1	(cm)		26- Apr-99
3		3134 equiv. Gales	RAM-based GaAs.	SS	=					<u>\$</u>		BNI	LaBel, et al. 97IEEE Writabp Rec., pg 14. Reconfiguration/snapback enus.
GSRC	KU911		Rad-hard, 2 µm epi (3.0 V)	¥.	18.8	~1.5E-06	_	<u> </u>	74-34	-		BNI	Katz, EEE Links, Vol. 3, No. 2, Jun 97, ne 24
GSFC	MKWII		CMOS, 10 µm ept (3.0 V)	MAT	13.2	3.0E-06			12-32			Z.	Katz, EEE Linkt, Vol. 3. No. 2. Jun 97 no 24
SRC	MO911		CMOS, 10 µm epi (3.3 V)	MAT	8.81	-1.SE-06	-	<del> </del>	8-32			_	Katz, EEE Links, Vol. 3, No. 2, Lin 97, no. 24
GSFC	QYHS80 LPGA	35000 gates (3.3 V)	Bulk CMOS, 0.8 µm features.	ΥVW	- 37	2.0E-06		† <del>-</del>	Feb-97	8,			KALZ EEE Links Vol 3 No 2 hooft ne 21
GSFC	QYHS&U LPGA	35000 gates (5.0 V)	Bulk CMOS, 0.8 µm features.	YAM	- 37			-	Feb-97	19	4.0E-05	$\neg$	KAIZ, EEE LINKS, Vol. 3, No. 2, Jun 1997, pg 21. LU X-section @ LET = 78. LU @
SAAB	RH1280 (5.0 V)	8000 equiv. 2-input gates	CMOS/epi (rad-hard LMA, 0.8µm	VCT.	36		4	4.5E-07	7661	+		$\neg$	-
SAAB	RH1280 (5.0 V)	BOXID equiv. 2-input gates	CMOS/epi (rad-hard L.M.A., 0.8µm	ACT	10		-	1.SE-07	766	+-		_	Mattern, et al. SAAB Dist. SE/REPARTEM FROM THE WAY CALL C. 4 15
SAAB	RH1280 (3.3 V)	BOOD equiv. 2-input gates	CMOS/epi (rad-hard LMA, 0.8µm	٧CT	25		90	8.0E-07	7851	-			Matton, et al. SAAB Doc. SEREPUTING 11997 DOC 6417 Concents and
<b>8</b>	SAAB RH1280 (3.3 V)	8000 equiv. 2-input gates	CMOS/cpi (rad-hard LMA, 0.8µm	ACT	æ		2	2.0E-06	7661			CAC	Mallson, et al. SAAB Doc. SEREPRITTRIK 11007 Dr. 0617 6. & 100 m. d. 1.
LMC	XC4036XL	36000 equiv. gates.	CMOS/7 µm epi, 0.35 µm (3.3 V).	XIL	<15				7661	001<		BNL	Lum, LMC Tech Memo TM26-98. 123° C. Upsets mainly in "basement" (control) logic.
SEI	IUUSULPRP	50k Gate reprogammable PLA	CMOS	нтс		3.7E-03			1661	>25	3.2E-03	N. L.	Lavion, et al. 981ESE Writchis Rec. 78 170
SEI	22V I UFR P	Reprogrammable PLA	СМОЅ	H	ı	7.5E-05			7661	S <sub>X</sub>		_	Javion. et al. 981555 Wrecha Box on 170
SĖI	22V10RP	PLA	СМОЅ	HTC	B	4.5E-04			, L661	<u>                                      </u>			Lavian et al 9815FF Writchn De 170
GSFC	22V 10RPFE	PLA	СМОЅ	SEI	<3.38			+-	, ree!	×72.9		$\neg \neg$	OBryan, et al., 981EEE Wrkshp Rec., pg 39. DK's XC34908493, XC 34950484 and
GSFC	22V10RPFE	PLA	CMOS	SEI	-10			+	+-	>72.9			002611202. FFF errors. O'Bryan, et al, 98IEEE Writshp Rec., pg 39. DACs XC34908493, XC 34950484 and
GSFC	HX2300	SOI Test Metal	RKMOS SOI4	NO.	>120		-	-	2661	130		E J	OUZO I 1801. Combinatorial errors. LaBel, et al., 96(EEE Writship Rec., pr. 19
GSPC	IMPSOETO	Electrical programmable Analog Gircuit	смоѕ	IMP	1.45			+-	1 7661	15 to 26.6		N. P. C.	LABel, ct al. 96IEEE Writshp Rec., pg 19.
GSPC	\$4ABT245	Octal Transceiver	BICMOS	NSC	001^				, 1991	×100		BN. E.	O'Bryan et al 981FFF Writchn Box no 30
GSRC	54ABT245	Octal Transceiver	BICMOS	돭	>100			-	, 7991	7100	+		OBryan et al. 98 IEEE Writchin Rec. no 30
<u>r</u>	74LVQ244	Bufferkepi (3.3 V)	СМОЅ	NSC		-		₹	Apr-96 >	×120	+		
GSPC	AM7968 & AM7969	TAXI Transmitter & Receiver	Bipular	AMD	3.4		-	<del>                                     </del>	<u>38</u>	\$ ×	-	BNL	LaBel et al. 97IEEE Writshp Roc., pg 14. Data and synch errors. Synch errors required
MMS	АМТУСУВ	Twisted Pair Transceiver	СМОЅ	AMD	7			+	5661	8	0	GANIL	power react. Polvey, et al. 90/EEE Witchip Roc., pg 73, D/C 9545 1.11 cmass sections at 1 cm_en.
MMS	DP8392CV	CONXIAL Transceiver Interface	Bipolar, low power Schouky, junction isolated	SC	7	2.0E-13		<del>                                     </del>	. 2661		0	1_	Poivey, et al., 96IEEE Writshp Rec., pg 73. D/C 9545. Transmit mode. Erruns
S	MMS DP8392CV	Coaxial Transceiver Interface	Bipolar, low power Schottky, junction isolated	NSC	7	2.0E-14		-	\$661	98	0	SI SI SI	Ost Informatizact/ransmitted bit.  GSI Informatizact/ransmitted bit.  GSI Informatizact/ransmitted bit.
										1	1	7	THE STATE OF THE S

TABLE 1 Heavy Ion SEE Testing - 1996 to 1998

13					Effections			-	-	-		
ਰ	Device	Function	Technology	M K	SEU LET	Xection		ion   Test	- ro	LU LU	iona – Fac.	Remarks
1					Threshold	(cm²) Te	Tested (µm²)	2 Date	-	(cm <sup>2</sup> )	٠,	26-Apr-99
록	LV244	Octal Buffer/driver (3 V)	СМОЅ	PHL				Apr-96	021<	Q	BNL	Tested  ⊕ 90° C.
ğ	LVC245	Octal bidirectional buffer	смоѕ	PHL				Apr-96	88		BNI	L Lauchup current > 50 Ma.
GSRC	. МКС429АЛВ	Linear Driver		MIC	>84.7			7661	× 7.4.7	7	P. I.	O'Bryan, et al, 98IEEE Writshp Rec., pg 39. No memory elements
GSPC	SNJ54ABT245AJ	Octal Buffer/driver	смоз	TIX	>100			1997	>100	9	B.N.	T
GSFC	UT63M147-BPC	1553 Transceiver	смоѕ	UTM	11			9661	×35	_	BNL	LaBel, et al, 971EEE Writship Rec., pg 14.
뢰	CD4014	Shift Register	смоѕ	HAR	>120	•		Apr-96			BNL	Tested @ 125° C. D/C 9403. Test of newer vintage CD4xxx (amily.
NASD/	NASDA 93419	512-bit	Bipolar	FSC?								Shimano, et al. 911EEE TNS, Vol. 38, NO. 6, pg 1693
GSPC	GSPC 68128	128K x 8	CMOS (1.0 µm) w/NMOS periph.	ΕĦ	1.45			1995	×	-	R.	1
SRC	68128	128K x 8	CMOS (1.0 µm) w/NMOS periph.	HTC	3.38			1995	**	-	BNL	
GSPC	68128	128K x 8	CMOS (1.0 µm) w/NMOS periph.	нтс				5661	*	-	BNL	LaBel, et al, 96/EEE Writshp Roc., pg 19. Address errors.
NASDA	NASDA µPD4464D-20	2K x 8	смоѕ	NEC				7661	4.56	5 2.46-01	01 ver.	Goka, et al, 981EEE TNS, Vol. 45, No. 6, pg 2771.
SE	32C408	512K x 8	СМОЅ	SEI	3.3	3.5E-05		7661	, til	_	BAL	Layton, et al. 98 IEEE Writshp Rec., pg 170.
NAŞDA	NASDA 38510/19101XCR	64K	CMOS/epi	NEC	16.6	6.4E-02	1.0E-06	7561	5,	-	TIARA	A Goka, et al, 981EEE TNS, Vol. 45, No. 6, pg 2771.
NASDA	NASDA 3851092XXIXB	256K	СМОЅ	нтс	1.2	5.1E-02	2.0E-07	7661 7	×		VIII.	Goka, et al, 981EEE TNS, Vol. 45, No. 6, pg 2771.
GSRC	SCIONRFE-M	128K x 8	смоз	VIV	<3.38	2.0E-01		1661	š		BNL	O'Bryan, et al, 981EEE Writshp Rec., pg 39. Multi-bit errors also seen.
MMS	ASSC4008CW-35E	512K x 8	CMOS/epi, 0.5 µm feature size	MOT	7		8.1E-07	2			CAC	Poivey, et al. 98IEEE Wrtzhp Rec., pg 68. D/C 9731. MOT chips packaged by Austin.
GSRC	ASSC512K8	512K x 8	смоѕ	AUS	<3.38	1.06-03		1993		ļ	BNI	O'Bryan, et al, 981EEE Writshp Roc., pg 39. Multi-bit errors also seen.
MMS	CXKS81000BP-10LL	128K x 8	смоѕ	SNY	7-7		1.06.08	7561	**		CAC	Poivey, ct al. 98IEEE Writalip Rec., pg 68.
MMS	HM628128BLP-7	128K x 8	HiCMOS, U.8 µm (eatures, Rev B.	нтс	-2		3.0E-07	7661		-	CAC	Poivey, et al., 981EEE Writahp Rec., pg 68. D/C 9713
MMS	HM628512ALP-7	512K x 8	HICMOS, 0.5 µm features, Rev B.	нтс	-2		2.0E-07	7661			CYC	Poivey, et al., 98IEEE Wrtabp Rec., pg 68. DrC 9705
SN	HM65656	32K X B	CMOS, 0.8 µm, rad-tolerant	MTA	7	1.5E-01		1997		_	BNL	Dodd, et al, 981EEE TNS Vol. 45, No. 6, pg 2483.
MMS	MMS 1561C1024-20M	128К я 8	СМОЅ (0.5 µm)	SSI	-5		1.5E-06	7661	**		CAC	Poivey, et al. 98IEEE Writathp Roc., pg 68.
MMS	KM864002AJ-17	512K x 8	CMOS/epi, 0.5 µm feature, Rev A	SAM	-		1.0E-07	7661	_	_	CAC	Poivey, et al. 98IEEE Writshp Rcc., pg 68.
SN.	M65608	128K x 8	CMOS, 0.5 µm, commercial	ΜŢΑ	7	10-30-1		7861			BNL	Dodd, et al, 98IEEE TNS Vol. 45, No. 6, pg 2483.
NS L	М6560ЖЕ	128K x 8	CMOS, 0.5 µm, rad-tolerant	MTA	-1	8.0E-02		7661			BNL	Dodd, et al. 981EEE TNS Vol. 45, No. 6, pg 2483.

13	7				304	-		-	-	-		
ŏ	Device	Function	Technology	Mfr	SEU LET**	Xsection B	Bits   Xsection	ion Test		Xsection	 Fig.	
					Threshold	(cm²) Tea	Tested (µm²)	) Date		-	_	Notice 13
R Z	L M65964	64K Test Vehicle	CMOS, 1.0 µm, rad-tolerant	ΥTΧ	7	10-30:1		1997			BNL	Dodd, et al, 981EEE TNS Vol. 45, No. 6, pg 2483.
MMS	S MCM6246WJ20	512K x 8	CMOS/epi, 0.5 µm feat., Rev W51.	MOT	7		1.0E-07	7661		-	CAC	<del>                                     </del>
SNI		16K Test Vehicle	CMOS, 0.5 µm, rad-tolerant	SNL	×	3.0E-03		1997	-	-	BNI	
Ŗ	, 28FUIGSA	2M x 8 or 16M x 1, NOR	ETOX process	INI	7	1.0E-06 to		Nov-95	4		BNL	Schwarz, et al. 971EEE TMS, No. 6, no 2315, Dec users Emergened account
Ξ,	28F016SV	2M x 8 or 16M x 1, NOR	ETOX process	돌	7	1.0E-06 to		Nov-95	1	_	Z	Schwarz et al VIEFF TNe No. 6 - 2011 C. Contract
텻	KM29N16000	2M X 8 NAND	CMOS	SAM	=	2.0E-04 4000	8	Mar-97	┵.		B. I.	
互	KM29N32KKI	4M X 8 NAND	СМОЅ	SAM		Æ	*	Mar-97	<del></del>		BNIL	
GSPC	C 011640W1C-70 Rev C	4M x 4	СМОЅ	IBM	3	7.0E-02		Dec-96	2	2.05.04	Z.	I skol et al GAIEDE Watche De on O
GSPC	2 011640WIC-70 Rev C	4M x 4	СМОЅ	B M	8	7.0E-02	-	26.9K	-	2.05.04	+	$\neg$
GSPC	GSFC 0116400J1D	4M x 4	СМОЅ	IBM	<3.38		-	362	× Si	+-	+	Label et al VIEFF Writch Bee no 14 Discours
GSRC	0116400JID	4M x 4	CMOS	IBM IBM	3.9		-	35	× S.I.s	-	SC SC	Label et al OTIEFF Writch Do no 14 Bined block
ESA	0117400BT1E-60	4M x 4 (3.3 V)	CMOS (IBM - ES3)	BM	7		4.0E-08	- -		_	YY S	Haden Co.
SEI	14C0164RP	4M x 4	CMOS	Ξ	45	3.0E-01		——	3		nCB	natore-Surfaten, ci al, 981EEE Witshp Rec., pg 74.
룟	D426S165G5	4M X 16 EDO (5:0 V)	CMOS	NEC	7		1.0E-15			_	MAT 2	C A ANEXAGO
로	HMS16S16SAJ	4M x 16 EDO	CMOS	Ξ	8		1.08.06					OWER PROPOSED PREPRIED LIVE VISBALERIO, A section without row or column upnets.
ES	HM51W16100B	CMOS	CMOS	E 3	7		•	4				Switch MADEL STREET DATE THE STREET DATE STREET
ESA	HMS1W16100B	4M x 4 (3.3 V)	CMOS	2		18.4W)	, 9	4			נונ	CHATOGE-SOTTHREE, 61 at, WILELE WITHING Rec., pg 74.
E	KM44V4100AJ	4M x 4 (3.3 V)		WYS	+	4 8 5-01	3.06.14				CAC	Martine-Suffixen, et al. 981EEE Wirtshp Roc., pg 74.
록	KM48V8104AS-6	8M x 8 EDO	СМОЅ	SAM		1.3E+00	2 OE-16				5 2	Partoce-Surensen, et al. 98 IEEE Wirtabp Rec., pg 74.
GSPC	M1611D2 (Scimens 1994)	4M x 4 (3.3 V)	CMOS	IBM ES3							<u> </u>	Nature, Actual Code preprint. Dr. 9/3/. Units section without row or column upsets. Harboe-Sorensen, et al. 981EEE Witchin Rec. no. 74
ESA	MT4LC4M4D42 Rev T	4M x 4 (3.3 V)	CMOS	MCN	7		6.0E-08	7661 1			CAC	Harboe-Swensen, et al. 981EEE Wrkahn Rec. no 74
蛘	TC5165805AFT-50	8M x 8	CMOS	TOS	-	1.0E-08		1998			BNI	Swift RADECSy8 preprint DX 9721 Cross section without
GSFC	TMS416400D1-60	4M x 4	СМОS	Τ̈́	<2.5			1996	×		BNE	LaBci, et al, 971EEE Writishp Rec., pg 14. Bit errors.
GSPC	28C010TE	128К я 8	СМОЅ	HTC	<b>3</b> 5			1997	₹		E E	O'Bryan, et al, 98 IEEE Writchip Rec., pg 39. Static mode testing.
				!								

TABLE 1 Heavy Ion SEE Testing - 1996 to 1998

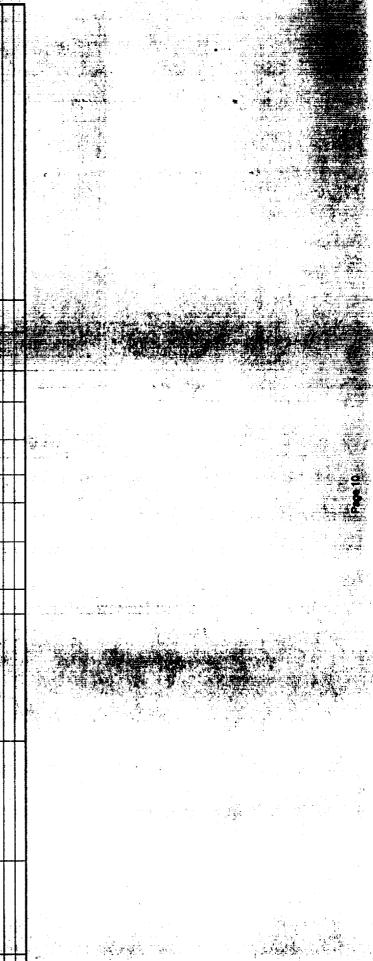
1												Ī	
ō	• Devace	Function	Technology	Mfr	SEU LET**	Xsection	Bic	Xsection	Test	 ::	LU X	<u>.</u>	Dannide
					Threshold	(cm²)	Tested	(um²)	Date		(cm²)	į	26-Apr-99
GSFC	28C010TE	128K x 8	смоѕ	нтс	~20				1661	<b>3</b> €		N.	OBryan, et al., 98IEEE Witshp Rec., pg 39. Programming mude testing. Byte errors @ -25. Start bits @ -59.7
GSPC	S7C256F-35		СМОЅ	ISM					1661	<18.8		BNL	O'Bryan, et al, 981EEE Wrkashp Rec., pg 39. DrC 9718
GSPC	ASS&C1001SF-15E	l Mbit	СМОЅ	нтс	>37				1661	15%		B.L.	OBryan, et al., 981EEE Wrkshp Rec., pg 39. DrC 9646. Static mode testing.
GSFC	ASS&C1001SF-15E	1 Mbit	СМОЅ	нтс	~18.8				7661	75.		N.	OBryan, et al. 98/EEE Writahp Rec., pg 39. Programming mode testing. Block errors and one stuck bit @ LET = 37.
GSFC	E28FU16SB	IM x 16 Flash	смоѕ	INT	9 to 11.4				2	26.2 to 29.9	1.0E-06	BNL	LaBel, ct al. 96(EEE Wrtshp Rec., pg 19.
ARSP	MG8UC186-12/B	NOP	CMOS III	喜	01	3.0E-04			1661	<b>8</b>	·	RON.	Crain, et al. 98IEEE Wirtshp Rec., pg 51. DVC 8951. Loctup emus begin 🔟 LET = -10.
ARSP	MGB/C186-12/B	ALU, Bus Unit	CMOS III	ĭ	2	2.0E-04			7681	ş		<b>g</b> On	Crain, et al, 98IEEE Writshp Rec., pg 51. DAC 8951. Lockup errors begin & LET = -10.
ARSP	MGBUC186-12/B	General register	CMOS III	Z	2	7.0E-04			1991	Ę		R <sub>O</sub> n	Crain, et al. 98IEEE Writshp Roc., pg 51. DAC 8951. Lockup errors begin @ LET = -10.
ARSP	MG80C186-12/B	Segment register	CMOS III	Ā	92	5.0E-04			756	28		5	Crain, et al. 98IEEE Writshp Rec., pg 51. DVC 8951. Lockup errors begin @ LET = -10.
ARSP	MG8UC286-12/883	NOP, ALU	СМОЅері	HAR	10	5.0E-04			7661	¥		nCB	Crain, et al. 98IEEE Writshp Roc., pg 51. DVC 8936. Lockup errors begin & LET = -5.
ARSP	MG80C286-12/883	General register	СМОЅчері	HAR	10	1.0E-03			7.891	, ž		<b>8</b> 23	Crain, et al, 98IEEE Wrkahp Rec., pg 51. D/C 8936. Lockup errors begin € LET = -5.
ARSP	ARSP MG80C286-12/883	Segment register	CMOS/epi	HAR	10	7.0E-03			1997	£8.		B C	Crain, et al, 98IEEE Wrtshp Rec., pg 51. DVC 8936. Luckup errors begin € LET = -5.
ARSP	MG80C286-12/883	Bus Unit	СМОЅкері	HAR	7	5.0E-03			7661	×63		UCB	Crain, et al. 98IEEE Writchp Rec., pg 51. DIC 8936. Luctup errors begin @ LET = -5.
록	6x86-PR166+GP	166 MHz Penuum	СМОЅ	CYR	1.7	1.0E-04			Dec-97			TAM	JPL internal report. Cross section
SEI	#M#6DX2RP	50 MHz test frequency	CHMOS V (0.8 µm), 5.0 V	볼	654	2.0E-03			7661	3		Z Z	Layon, et al, 981EEE Writahp Rec., pg 170.D/C 9527527C. Cache on.
SEI	80486DX2RP	50 MHz test froquency	CHMOS V (0.8 µm), 5.0 V	TNI	5.4	1.5E-04			L661	7		BNL	Layton, et al, 98IEEE Writaby Rec., pg 170.DAC 9527527C. Cache off.
281	WAK6DX4		3LM CMOS (0.5 µm) - 3.45 V	AMD	1.5	2.5E-03			986	٠,		TAM.	Kouba, et al. 971EEE Writshp Rec., pg 48 & JSC Test Report 12/96. Threshold/X-section with each on X-section ussal. @ LET = 25. 8 error modes seen.
St	80486DX4		3LM CMOS (0.5 µm) - 3.45 V	AMD	4.5	2.5E-03			961	ئ		TAM T	Kouba, et al. 97IEEE Writath Rec., pg 48 & JSC Test Report 12/96. Same as previous bus threshold?X-section is for cache disabled.
GSPC	H30466A-21		CHMOS IV	SEI	5 to 6				5661	35 to 37.5		<b>M</b>	LaBel, et al. 96IEEE Writahp Roc., pg 19. Micro latchup only. Count error cleared by reset.
GSPC	H30466A-21		СНМОS IV	SEI	3.4 to 5				\$ <del>6</del>	35 to 37.5		BN.	LaBel, et al, 96/EEE Writahp Rec., pg 19. Micro lauchup only. Reset errors
GSFC	H30466A-21		CHMOS IV	SEI	6 to 11.4				5661	35 to 37.5		BNL	LaBel, et al, 96IEEE Writshp Rec., pg 19. Micro lauchup only. Lockup cleared by reser
ਵਂ	KS-PR166ABX	166 MHz Pentium	CMOS (3.5 V)	AMD	4.0	6.3E-08		_	76-m/	0.37	1.3E-06	BNLS	Saumled LU cruss section ~1.0E-01 cm². LU destructive.
록	KS-PR166ABX	166 MHz Penium	CMOS (3.5 V)	AMD	<li>&lt;1.7</li>	6.3E-08			Dec-97	1.7	1.0E-06	BN.	Salurated LU cross section -2.0E-03 cm <sup>2</sup> . LU destructive.
GSPC	GSFC MG80486DX2-66		CHMOS V	Ē	4.3 to 7.9				1997	26.6 to 37.3		BNL C	OByan, et al. 98IEEE Wirkatp Rec., pg 39. D/C 9451. Dynamic tests with and without cache enabled. Both data and lockup SEUs observed. Also microlasches and destructive SEL @ LET >26.6

T					Effection	S. Francisco				<i> </i>			
0	• Device	Function	Technology	X Fr	SEU LET**	Xsection	Bits	Xsection	<u>1</u>	 מיי	Xection	ŭ,	Remarks
					Threshold	(cm²)	Tested	(µm²)	Date	$\neg$	(cm²)		26-Apr-99
GSRC	C Mongouse V (R3000)	RISC	CMOS/SOI (Honeywell)	SYN	×83				1661	× ×		BNL	O'Bryan, et al, 981EEE Writshp Rec., pg 39. Cache off.
GSPC	2 Mongouse V (R3000)	RISC	CMOS/SOI (Honeywell)	SYN	94-				7661	*		BNIL	O'Bryan, et al, 981EEE Writshp Rec., pg 39. Cache on.
GSPC	C MQ80386-25/B		CHMOS IV	Ä	4 to 5	8.0E-05				30 to 32		B. L.	LaBel, et al. 96IEEE Writshp Roc., pg 19. Micro laschup only. Count or lockup cleared by
GSPC	C MQ80386-25/B		CHMOS IV	Ē	5 to 6	1.5E-03			3	30 to 32		Na Na	tener.  LaBel, et al, 96/EEE Writishp Rec., pg 19. Micro latchup only. Lockup cleared by reac.
HON	RH-32	RISC	Honeywell HI Process	HON	-30			4.6E-07	7581	587		BNL	Leavy, et al, 98IEEE Writahp Rec., pg 11.
GSPC	82C54	Time	СМОЅ	K	6				2661	<b>2</b>		BNL	LaBel, et al, 96IEEE Writstop Rec., pg 19.
GSPC	; D8255A-5	Prog. Peripheral Interface	43.6	Ŗ					5661	39.6		N N	LaBel, et al, 96IEEE Writshp Rec., pg 19.
MMS	DP83932CVF	Network Interface Controller	M²CMOS (1.0 µm)	NSC					1995	15	3.06-03	GANIL	Poivey, et al, 961EEE Writabp Rec., pg 73. DVC 9442.
MMS	DP83950BVQB	Repeater Interface Controller	M <sup>2</sup> CMOS (1.5 µm)	NSC					5661	SI L	1.0E-03		Poivey, et al, 96IEEE Wittahp Rec., pg 73. DVC 9506.
MMS	DP83956AV∐	Repeater Interface Controller	M <sup>2</sup> CMOS (1.5 µm)	NSC					2661	8	2.5E-03	13	Poivey, et al, 96IEEE Witshp Rec., pg 73. DVC 9452.
GSFC	. M82C59	Interrupt Controller	СМОЅ	HAR	4.				1995	9 <del>4</del>		T	LaBel, et al, 96IEEE Witsap Rec., pg 19.
GSRC	MQ82380-25/B	32-bit Integrated Peripheral.	CHMOS III	볼	3.4				1995	15 to 30		BNL	LaBel, et al. 96IEEE Witshp Rec., pg 19. Reset errors cleared by reset. Microbaches. Also a classic 11 or SEE self sea.
GSFC	п.1705	Power Supervisor	Bipolar TTL	¥	3,4 to 4.5	8.0E-05			9661	8,4		BNL	LaBel, et al. 97IEEE Writshp Rec., pg 14.
GSFC	TL7705-5	Power Supervisor	Bipolar TTL	XIL	7.5 to 11.6	1.06-04			9661	× ×		BNL	LaBel, et al, 971EEE Wrkshp Rec., pg 14.
GSFC	MGK/387-2U/B	Math Unit	СНМОS IV	ŢŃ	9 to 11.4				1995 32	32 to 35		BNL	LaBel, et al, 96IEEE Witshp Rcc., pg 19. Microlauches observed.
ARSP	LM108	General Op-Amp	Bipolar	NSC	2	~5.0E-03			7661	<b>₹</b>		E S	Koga, et al, 971EEE TNS, No. 6, pg. 2325. DKC 9533. No LET, dependence on input
ARSP	OP-42	Precision high Speed, fast settling Op-Amp	Bipolar	ΙQV	2	~2.0E-03			1997	ş		C B	vonge unta. Voltage detta. Voltage detta.
GSPC	ОР410	Quad, low power, low offset		PMI	20				1997	95		BNIL O. O.	Crain, et al. 98IEEE Writshp Rec., pg 39. D/C 9711. Transients only. Minimum delia-V = 0.25 V.
쩎	4N49	Single Transistor	899) µm (AlGaAs) lateral	HPA					1661				
Ĕ	6N140	Darlington Amplifica	700 µm (GaAsP) sandwich	HP.	=				7461		-	BNL Jo	Johnston, et al, 98IEEE TNS Vol. 45, No. 6, pg 2867.
草	HCPL-5203	Hi-Gain Amp.	700 µm (GaAsP) sandwich	HPA	0.3	~3.8E-03	-	<del>                                     </del>	1991			BNL Jo	Johnston, et al, 98IEEE TNS Vol. 45, No. 6, pg 2867. No saturation cross section @ LET = 40.
इ	HCPL- 5631 (6N134)	Hi-Guin Amp.	700 µm (GaAsP) sandwich	¥ ₩	0.3	~2.6E-03		_	<u> </u>			or Jug	Johnston, et al, 98IEEE TNS Vol. 45, No. 6, pg 2867. No saturation cross section @ LET = 30.
GSPC	HCPL-6651	High speed logic output	-	нРА	<0.03			_	1997			BNL O	O'Bryan, et al. 98(EEE Wrkshp Rec., pg 39. SET & LET <0.03
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	Remarts		Cross section saturation = 3.0E-04 # LET = 80.	LaBel, et al. 97 IEEE Writabp Roc., pg 14. Short (<20 µs) errors.	LABC! et al, 97 IEEE Writshp Roc., pg 14. Medium (20 - 100 µs) errors.	LaBel, et al, 97 IEEE Writzbp Roc., pg 14. Lung (>100 µx) errurs.	LaBel, et al. 97 IEEE Writshp Rec., pg 14. Singe-bit SEUs.	LaBel, et al, 97 IEEE Writshp Rec., pg 14. Double-bit SEUs.	LaBel, et al. 97 IEEE Writshp Rec., pg 14. Multiple-hi SElls	OBryan, et al, 98IEEE Writahp Rec., pg 39.	LaBel, et al, 96 IEEE Wrtshp Rec., pg 19.	Koga.ci al, 971EEE NSREC TNS, No. 6, pg. 2325. D/C 9627.	Koga, et al., 97IEEE TNS, No. 6, pg. 2325. DIC 9605. No LET $_{\rm lb}$ dependence on input	Voltage delta. Transieni tesi only.	Koga, et al., 971EEE TNS, No. 6, pg. 2325. DIC 9619. Very strong LETth dependence	var input voluage certa.  Koga, et al. 971EEE TNS, No. 6, pg. 2325. DIC 9535. No LETth dependence on input	vouge oeta. Tanaien test only.	Transen test only	O'Bryan, et al, '98IEEE Writsho Rec., pe 39	Kogs, et al. 97IEEE TNS, No. 6, pg. 2325. D/C 9318. Very strong LETth dependence on inner volume delta.	and in this waste, and	Koga, et al., 97 IEEE TNS, No. 6, pg. 2323. DKC 9305. West LETIh denendeans no innua	
		_	TAM	BNI	BNL	TAM	BNL	BNI	BNL	BNI	BNI	<b>8</b> DN	nc.	BNL	#Dn	E C	BML		1	RON CB		2	
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TABLE 1 Heavy ion SEE Testing - 1996 to 1998

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The state of the Corn Touristic Corn	f	1	EL. Corp. ADA = Advanced Assalog	Devices; ADI = Analog Devices, Inc.; Al		dvanced Micro	devices Corp.	K BOE - B	Joeing Corp	2	L	_			
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Letter Forest and the Control of Location March and	Ť	OTF = Ceseficity HAM = Ham	nemetre; HON = Honeywell; HPA =	Howhost-Packand; HTC = Hitachi, Lat. II	BM - L	sternational Bus	tinces Machin	. IVP	DAP, Inc.	MT = Imp	2	-			
Golden Selected Secretaries   Fig. 2   National Cong. NCO = National Secretaries   Cong. NCO = National Sec. NCO = National	T	ISS = ISS, Inc; ITP = interpoint	v; LMA = Lockhood-Martin; MAT :	* Matematika, Corp. MCN = Micros Tool		s; MDI = Mod	ular Devices,	Inc. MHS	= Matra-H	lenis Semi	Condecor	Present P	┢		
Becoming, Lies Selected account PRIL = Public   Advancates Microbia Monthleis, Inc. (Oil = Opticarrick). Inc. (Opticarrick). Inc.	f	MOT - Motorola Semiconducta	tor Products; MPC = Micropec, Corp	v; MCM = Maxim; NBC = Nippon Elect	S C	NSC = Nation	and Semicond	tector Cor	O-NO:	PICA Nor	oft.	-			
The Decremina, In-TSE 9 Steneols Components, In-SCOS = SOS-Thompson; SEP 9 Ripor, SIV = Studie Neticnal Laboratories, SNV = Sprovit; TIX + Testa International Control of the Control of t	۲	OPT Opeck; ORP = Orbit Somit	iconductors; PHL = Phillips Laborate	ories; PMI - Precision Monotitale, Inc; (		wickswitch, Inc.	RAY = Rey	Choose; SA	N - Seese	SCI.	ACI Sympa	a social	pectra D	Node Labs;	
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¥	RDHM32C10 KNGR	32% #8	8000	ā	s.	-	=	1.88-13 Apr-91	<del> </del>		3	
ă	EDHERSTCHOOL.	335.1	9000	ā	ş		2	9.5E-14 Mar-91	<u> </u>		3	
ă	EDHEROSCIOCO.	136.18	8	ā	æ		=	1.3E-14 Apr-91	Ŀ			Consess RADBCS97 Des Workley, pp. 19, DC 8894
ž	EDHEDZCIODCI.	3306.118		ā	8		9.38.13	EI3	_	1		A PART OF THE PART
ă	EDHEROZC-15JAHR	326 18	C)400	ā	я		=	1.8E-13 Apr-91	<u> </u>	警		TO THE PARTY OF TH
á	EDEMONCE 35QS	SK x 8	Chick	ā	95	-	2.06-12	-12 Aug 94		1	F	Harriston RADECSY Data Workshop, pg. 89. DrC 9103
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oli o	Device	Patentina	Technology	JE .	Energy (McV)	Xeccion 7	Total Xaculus (cm²)	Section Date	  # #	Xection 1	- E - C	Banneds
£SA	EDIMINE 150DB	KK x E	CMOS	ā			-	╂	Aug-94 209	<b>├</b> ∸	<b>₽</b>	Mertono-Soromon, RADECS97 Data Workshop, pg. 89. DIC 9033
ESA	EDIBBI 28C100CM	128K x B	CMOS	ā	905		=	1.3E-13 Apr-91	14-	-	**	
ESA	EDIBILI 30H45CM	128K x 8	СМОЗ	Ē	300		2.5	2.5E-13 Apr-93	£6-	-	분	Hartro-Sormann, RADECSY7 Data Workshop, pp. 39. DC 9111
ESA	HM1-6504-2	4K x 1	СМОЗ	HAR	98		Ø	<5.3E-15 Jun-89	3		282	Harbon-Soromen, RADBCSY7 Data Workshop, pp. 89. DC 1222
ESA	HM1-6504-5	4K z l	СМОЅ	HAR	98		\$	<5.3E-15 Jun-89	<b>3</b>		28	Hartne-Soremen, RADECSV7 Data Wortsing, pp. 89. DrC 7943
ESA	4-M41-6504-9	4K x l	смоз	HAR	600		Ť	<8.4E-15 Nov-89	2		F	Marton-Sarpasen, RADECS97 Data Workslay, pp. 89. DC 8508
ESA	HM1-65162-2	2K x B	СМОЅ	MHS	8		-	4.2E-13 Nov-89	3		ř	Harbon-Sormann, RADECSYT Data Wurtsings, pg. 59. DC 5740
ESA	HM1-65162-2	2K x 8	СМОЅ	MHS	500		5.0	5.0E-13 Apr-93	66:		Ē	Harbon-Scremen, RADECSY/ Data Workshop, pg. 89. DC-6740
ESA	HM1-65162-2	2K x B	смоз	MHŠ	300		7.6	7.6E-13 Apr-93	ž.		ř	Harbon-Surmaem, RADECSY7 Data Wurkship, pg. 89. DIC 8902
ESA	HMI-6516-9	2K x #	сиоз	HAR	99		2.4	2.4E-14 Jun-89	<b>2</b>		XB.	Harbus-Summern, RADECS97 Data Workshop, pp. 89. DC 8313
ESA	HM1-6516-9	2K n 8	смоѕ	HAR	100		1.5	1.5E-13 Nov-89	2,		Ē	Harboe-Surenees, RADECS97 Data Workshop, pg. 89. DC 8313
ESA	HM1-65262-2	16K x 1	СМОЅ	MHS	001		3.5	3.5E-13 Nov-89	<b>2</b>		Ē	Harboe-Soromera, RADECS97 Data Wirtschup, pg. 89. DC 8714
ESA	HM1E-65664B-2	BK x B	смоз	MHS	<b>3</b> 5		425	<2.9E-14 Apr-93	£.		Ē	Harbre-Soreneen, RADECSY7 Data Wurkshap, pg. 89. DrC 9114
ESA	HM1E-650648-2	SK x S	СМОЅ	MHS	300		1.5	1.5E-13 Apr-93	8		2	Harboe-Sormaon, RADECS97 Data Wurkahop, pg. 89. D/C 9114
ESA	HM6116P-3	2K n 8	смоз	Ħ	\$		3.1	3.1E-14 Jun-89	<b>£</b>		VBC	Harbine-Sargineni, RADECS97 Data Winkshop, pg. 89. DIC 8638
ESA	HM6116P-3	2K x 8	СМОЅ	ЭЦН	50%		3.8	5.8E-13 Nov-89	68		<u>s</u>	Harture-Surcesson, RADECS97 Data Workship; pg 89. DrC 8638
ESA	HM6116P-3	2K x 8	смоз	HTC	906		3.6	3.6E-13 Apr-91	<del>2</del>		SAT	Harbie-Styrensen, RADECS97 Data Workship, pg. 89 DC 8638
ESA	HM62256P-10	32K x 8	смоз	ΉЩС	KO2		9.	1.6E-13 Nov-89	36		<u>x</u>	Harbre-Syrrauen, R.A.DECS97 Data Wurkship, pg. 89. DiC 8817
ESA	HM62256P-10	32K a 8	смоз	H	200		2.9	2.9E-13 Apr-91	<del>-</del>		SAT	Harbus-Sarensen, R.A.DECS97 Data Warkshap, pg. 89. DKC 8817
ESA	HM6264ALP-15	XX x 8	CMOS	HTC:	99		1.2	1.2E-13 Apr-91	15		SAT	Hartue-Sorenson, R.A.DECS97 Data Workship, pg. 89. DC 8901
ESA	HM6264LP-15	жкхж	смоз	HH:	\$		3.9	3.9E-14 Jun-89	ž		VEC	Harbus-Sirenaum, R.A.DECS97 Data Winkshipp, pg. 89. DIC 8413
ESA	HMn204LP-15	жхж	СМОЅ	Ë	20		12	1.2E-13 Apr-93	23		78	Harbio-Sironach, R.A.DEC'S97 Data Wirkship, pg. 89 DiC'8413
ESA	HM6264LP-15	XK x K	смоз	нщ	200		5.6	2.9E-13 Apr-93	8		SAT	Harhac-Sarotsan, R.A.DEC'S97 Data Workship, pg. 89. DC K413
MMS	HM628128B1.P.7	128K x K	HiCMOS, 0.8 µm teatures, Rev B.	E L	×		3.0	3.0E-14 1997	4		<u>R</u>	Privcy, ct al., VRIEEE Workship Round, pg n8. DK' 9713
ESA	HM628128L-10	12NK 1 8	СМОЅ	HIC	æ		0	1.0E-13 Apr-91	16		SAT	Hartuc-Sirenson, R.A.DEC'S97 Data Workship, pg. 89. DIC 9009
ESA	HM6281281-10	12KK 1 8	смоя	Ŧ	300		5	9.0E-13 Apr-93	S		Ē	Harther-Streiment, RADEL'S97 Data Workshipp. pg. 89. DIC 9009/35
MMS	HM628512ALP.7	512K x 8	HiCMOS, 0.5 µm features, Rev B.	Ĕ	97		0.1	1.0E-13 1997	7		Ē	PHYCY, CI 21, 981EEE Winkship Round, pg 88. DIC 9705
ESA	HM628512P-7	128K x 8	СМОЅ	нтс	300		2.31	2.3E-13 May-94	3		Ē	Harbac-Surensen, RADECS97 Data Wurkship, pg. 89 DiC 9235
ESA	HM-oSoSo	32K x B	смоз	MHS	300		3.91	3.9E-13 Apr-93	55		ž.	Harbue-Sirensen, RADEC'S97 Data Wintship: pg. 89. DIC (sample)

1					ď		-	ŀ	-			
30	bence	Function	Technology	Mir	Energy (MeV)	Xxection Te	Tested Xextion (cm.)	non Date	"n]	Xxxxtinn (cm²)	Ĭ.	Remorts 8- has ve
ESA	HM-65656E	32K x 8	смоз	MHS	33		1.66-13	13 Apr-93	~		Ē	Harhre-Streinen, RADE("SV7 Data Workship, pg. 89. DIC (suitple)
ESA	HMnSox7E	04K x l	CMOS	MHS	801		1.45-14	14 Apr.93	-		₹	Hartine-Sweinern, RADECS97 Data Workshap, pg. 89. DrC (sample)
ESA	HM-05097	256K x 1	смоѕ	MHS	300		4.0E-13	13 Apr-93	5		<u>z</u>	Harbuc-Streinen, RADECS97 Data Workship: pg. 89. DiC (sample)
ESA	HMC'E-65664B-8	XK x &	СМОЅ	MHS	001		3.96.14	14 Apr-91	=		ž.	Hartne-Sweimen, RADECS97 Data Workshipp, pg. 89. DC 9232
ESA	1D/T) 256 VBC	32K x B	СМОЅ	5	00%		2.4E-13	13 Apx-89	2:		SAT	Harbur-Swichken, RADEC'S97 Data Wirkship, pg. 89. DK: 8943
ESA	IDT71256-0K	32K 1 K	СМОЅ	ΤŒ	200		2.9E-13	13 Apr-89	2:		SAT	Harbac Surgingn, RADECS97 Data Workship, pg. 89. DK: 910381
ESA	IDT7164	ek 1 8	CMOS	TOI	æ		2.9E-14	14 Apr-91	_		SAT	Harbre-Swennen, RADECS97 Data Workship, pg. NV. DIC REVIOLB!
ESA	IDT716	*K x &	смоѕ	TOI	OX.		1.7E-13	13 Apr.91	=		SAT	Harbuc-Surcinson, RADECS97 Data Workshipp, pg. 89 DIC REVIOUBI
ESA	IMSTRAISSS ABF	OHK X I	смоз	ISM.	3		\$.1E-13	I. Nov-89	2		Ē	Harbus-Siromson, RADEC S97 Data Workship: pg. 89. DIC 8534
MMS	1561C1024-20M	128K x 8	CMOS (0.5 µm)	1SS	01	,	2.0E-13	788			<u>r</u>	PAVCY, CI 21, SKIEEE WORKSHAP RESINCE, PG 68
ESA	KM6M1UXDLP-R	128K x 8	СМОЅ	SAM	300		3.0E-13	13 May-94	7		Ē	Harbue-Sorcinson, RADECS97 Data Workshipp, pg. 89. DAC 2147
ESA	KM6840XXULP-5	128K x l	смоз	SAM	300		2.0E-13	13 May-94	4		Ē	Harbur-Savenban, RADECS97 Data Workshap, pg. 89 DAC 310Y
MMS	KM864002AJ-17	512K x 8	CMOS/ept, 0.5 µm teature, Rev A	SAM	-		4.0E-16	1997			Ē	PAYES, C. al., VRIEEE Workship Roserd, pg 68.
ESA	M5M51508BP-15	32К я 8	смоз	<b>™</b>	9.		6.0E-14	14 Apr-91	_		SAT	Hartuc-Surensen, RADECSV7 Data Workshipp, pg. 89. DiC 9271
ESA	MASolio	2K x K	смоѕ	MMS	90		3.0E-13	13 Nov-89	2		₹.	Harhar-Surensen, RADECS97 Data Workshipp, pg. 89. DAC 8737
ESA	MASolio	2К я В	смоѕ	MMS	300		<2.0e-15	15 Nov-89	2		₹	Hartus-Sarcman, RADECS97 Data Workship, pg. 89. DAC 8737
ESA	MBRICKIA-45	256K x 1	СМОЅ	£.	96		1.6E-13	13 Apr.91			SAT	Harbre-Sarcinen, RADECS97 Data Workshap, pg. 89. DiC 8820
Ę	MB84256-10L	32К к в	смоѕ	FUI	KOX		\$.0E-13	13 Mar-91	_		SAT H	Harbue-Swonson, RADEC'597 Data Workship, pg. 89. DiC 8948
ESA	MB84256-10L	32K x 8	СМОЅ	₽	906		3.7E-13	13 Apr-91	_		SAT	Harbuc-Steremen, RADECS97 Date Workship: pg. 89. DrC 8948
ESA	MB84256-151.	22K x B	СМОЅ	3	900		4.7E-15	15 Apr-91	_		SAT H	Harbre-Streuwen, R.A.D.E.C.S97 Data Workship, pg. NY. DiC Kn50
ESA	MBR464-15	XK x X	смоз	3	302		3.7E-13	13 Nov-89	<b>-</b>		<u>z</u>	Harbuc-Siretison, R.A.DECS97 Data Workship, pg. 89 DK 8431
MMS	MCMn246W12U	512K x 8	CMOS/epi, 0.5 µm teat., Rev W51.	MOT	×		3.0E-14	735			<u>K</u>	Pavey, et al. VAIEEE Wintschap Round, pg nk. DX. vrai2
ESA	MMI-6SHIII	4K x 1	СМОЅ	MHS	Ê		1.0E-14	14 Jun-89			VEC H	Harbue-Svermen, RADECS97 Data Workship, pg. 89. DrC 8619
ESA	MM1-6504H11	4K x 1	CMOS	MHS	90		9.0E-14	14 Nov-89	<b>3</b>		쭚	Harbus-Surenson, RADECS97 Data Workship, pg. 89. DiC 8619
ESA	MSM81285-70	128K x 8	СМОЅ	MR.	(XX		1.5E-14	4 Apr.93			ž.	Harbac-Sareman, RADEC'S97 Data Workship, pg. 89 DiC 9210
ESA	MSMK12KS-KS	128K x 8	СМОЅ	MR.	300		8.4E-14	4 Apr-93			<u>r</u>	Harbue-Sierensen, RADECS97 Data Wietsalngi, pg. 89 DiC 9252
ESA	MSM8128SLMB-45	128K x 8	смоя	MK.	300		3.46-15	5 Apr. 93			Ē	Harbre-Savensen, RADEC'S97 Data Wierlahrp, pg. 89. DIC 9188
ESA	MSMB12KSLMB-45	128K x K	CMOS	ME.	99		1.1E-14	May-92	-7		Ē	Harbre-Sveensen, RADEC'S97 Data Wirkship, pg. 89- DVC 9108
ESA	MTSC1008C-25	128K x K	смох	N. W	300		2 NE-13	3 Apr-91	_		SAT H	Harbac-Saransan, RADEC'S97 Data Workship: pg 89 DaC'9110

	1			F	Proton	Device	all all all all all all all all all all	Bit	Test	-	3			
Device		Fuenchens	Technology	Σ	Energy (MeV)	Xsection   Tested   Xsection	Tous X			"X   "I'I'	 8 .	<u> </u>	Remarks	
MTSC256 S12D 32	- 2	32K x 8	СМОЅ	W.C.	300		+	١,	10 mm	+	╂	1	8-Jun-yy	
MTSC2568 S02A		ж, ж	SOFT				+						Harbur-Sakensen, RADECS97 Data Workshap, pg. 89. DKT 1993(2)	
				ž	2		3	9.0E-14	May-94	-	+	ž	Harting-Singusun, RADEC'S97 Data Workshipp, pg. 89 DK, 9231	
MTX 2568 502A	-	32K x 8	СМОЅ	MCN	Жи		-	1.4E-14 Ma	May-94			<u>~</u>	Harbue-Streinsell, RADECS97 Data Workship, pg. 89 DKC 9231	
P4C1257-35CC	T	256K x 1	смоз	PFS	200		<u> </u>	9.4E.15 Ap	Apr-91			SAT	Harhire-Sareman, RADEC'SV7 Dada Workshop, pg. 89. DAC 8943	
QSK32kb-15P	ī	32K x 8	СМОЅ	ŝ				¥	Aug-94 3	8	c1.0E-13	z.	Harbur-Sweinsch, RADECS97 Dala Werkabay, pg. 89- DAT 9302	
SMJ61CD16LA-25		10K x 1	CMOS	Χ̈́L			-	Ž	Nov-89	209 <1.0	<1.0E-13	<u>\$</u>	Harbur-Surensen, RADECS97 Data Wirdahap, pg. 89. DrC 89004	
TCSS1001BPL-70L		128K x 8	СМОЅ	SOT	8		=	1.0E-14 No	Nov-96	-	+	2,5		
TC551001BPL-70L	1	128K x N	смоя	Tos	8		71	7.0E-14 No	Nov-96	-	1	C,C	Hartise-Strenken, RADEC'S97 Data Workship, pg. 89 DC 9623	
1C5516AP-2		2К х 8	СМОЅ	TOS	190		3	5.9E-14 Ap	16-MY	-	-	SAT		
TC551hAP-2	- 1	2K x x	СМОЅ	10 <u>s</u>	900		=	1.6E-13 Ap	Apr.91	$\vdash$	10	SAT	Harbuc-Surcinean, RADEC'Sy7 Data Wortschip, pg. 89. DCC 8333	
TC5510AP-2		2K x 8	смоѕ	TOS	45.4		-	4.1E-15 Jun	Jun-89	-		VEC	Harbae-Surenaen, RADEC 397 Dada Werkahap, pg. RV. DCC 8340	
TC55257P-10	-1	32K x B	смоѕ	TOS	30%		=	1.0E-13 No.	N.v-K9	-	-	<u>%</u>	Harbay-Soreman, RADEC'S97 Data Workship, pg. 89 DIC 8640	
TC5564PL-15		*K * *	СМОЅ	ZOT.				, a	Ne-mil	0.12	<1.0E-13 V	VEC	Hartne-Swennen, RADEC'S97 Data Werkshop, pg. 89. DCC 8514	
1C5564PL-15		** ***	СМОЅ	ZQT			-	Ž	Nov-89 20	203	<1.0E-13	Ē	Harbuc-Sveensen, RADECS97 Data Workship, pg. 89. DrC 8646	
TC55BR12KP-20		ZXK x K	смоѕ	TOS	ĝ.		7.1	2.1E-13 May	May-96		-	ž.	Harbire-Surenisen, RADEC'S97 Data Workship, pg 89. DrC'9230	
UM62256-10L		32K x 8	СМОЅ	Æ	300		=	1.8E-13 May	May-94		-	<u>~</u>	Harbin-Sireman, RADECS97 Data Wirthship, pg. 89. DiC 9036	
AM29LVKX)B-120		Park Menerity and and a second	CMOS	YWD	3		∛ <mark>વ્ય</mark> ું	6.0E-18 Nov-96	. : <u>!</u>	CYC			Helman Screens RADET VAT Day Washing as a December of the Control	
CATZBHUIGP-15 OES		1284K x X	СМОЅ	CAT	300		*	—	May-94	-	-		Harbre-Swanzen, RADECS97 Data Workshan ne 89 DKC 9213 Best mast	
MENFIOLISOPI VPS		LZM,K x 8	CMOS	SGS	300		*	<8.8E-17 May	May-94	-	-	<u>z</u>	Harbuc-Sweinen, RADECSV7 Data Wirkship, pg. 89 DIC 9344 Read mark:	
M2KF2So-15B1 VPRA		32K 1 K	смоз	SCIS	300		3	c3.5E-16 May	May-94		-	至	DAC 9389.	
M5M2KF101P-12		1284.K x 8	СМОЅ	μ	300		**	<8.8E-17 May	May-94			PS.	Hartner-Streetiscon, RADECS97 Data Workshipp, pg. 89 DK 312107 Read mask:	
P28F010-130		I 284K x K	СМОЅ	Ē	000		<7.6	<7.0E-17 May	May-94	<u> </u>	- a-	Ŧ Z	Harbre-Surginan, RADEC'S97 Data Workship, pg. 89. DKC U13602P1. Read navid:	
P28F512-120		64K x I	СМОЅ	N.	900	-	\$15	<1.5E-16 May	May-94		- A	Ē	Harfine-Sintishean, RADEC'S97 Data Workship; pg. 89. DIC U10938P2. Read mark:	
TMS284512-124C3NL			CMOS	Ķ	KK)			<1 KE-16 May	May-94	-	E	<u>₹</u>	Harbac-Sirreman, RADECS97 Data Workship, pg. 89 DC 9331 Read mark:	
,					- '	- :	- (- - (-			-		-		
HIDE TOAKE OF		** W	CMOS (5 0 V)	NEC.	197		7.8	7.8E-12 1996			5	IUCF I		
OI INMUIIC:70		4M x 4 (5.0 V)	смоз	M	63	2.0E.07		<u>5</u>	\$461		<u> </u>	acon	LaBel, et al. SolEEE Workshap Record, pg 19. Cell crius.	
ULIO-ACEDIC: 70		160 Mbit stack (50 V)	смоя	<u>ω</u>	761			<u>5</u>	5661		3	ACD L	LABCI, CI AI, VOIEEE WINKSAMP ROUND, PR 19. NI CITIES.	
OTTOMBUTO		4M x 4 (5 0 V)	смоз	IBM	63		151	1.5E-15 1996	ş		3	aon	LaBel, ct al. 971EEE Winkship Round, pg 14. Bit and think crims.	
							$\left\{ \right.$	1	$\frac{1}{2}$	-	$\frac{1}{2}$	_		

Test					Profession	Charter				-	-	
. An	Device	Function	Техтиннуку	₹	Energy (MeV)	Xxxxtient			 	LU <sub>ih</sub>   Xsacimus   Xsacimus   Assacimus	Heats -	Remarks
CSH.	UI INHAULID	4M x 4 (3.3 V)	CMOS	IBM	63		<del>                                     </del>	+-	9661		nCD	8-Jun-W. LaBel et al. 971FFF Workshop Record on 14 But and black a con-
CSK.	011640PTIC-70	4M x 4 (3.3 V)	CMOS	Ξ.	69	2.0E.09	-	$\perp$	ž	-	5	-
ESA	Ī	4M x 4 (3.3 V)	CMOS (IBM - ES1)	X	2		-			-	5   8	
	1			E .	<u>.</u>		-	0.46	3		ž.	Hartner-Sorrenson, or al. 98/EEE Workshap Roceard, pg 74
ESA	0117400BT1F-60	4M x 4 (3.3 V)	CMOS (IBM - ES4)	WB1	=		2	9.0E-16 1	1997		Ē	Hartwe-Swenson, ot al, 981EEE Workshap Recard, pg 74.
ESA	UI 14KOMJI D	1 M K I	СМОЅ	M M	300		7	2.1E-15 Au	₩-6-Яп		₹	Hathie-Seitheri, RADECS97 Data Werkship, pg. 89. DiC 9314
S. E.	4210400-70	4M×4(5.0 V)	СМОЅ	NEC.	63	\$.0E-07		_	556		25	Labet, et al. 90/EEE Workship Round, pg. 19. Cell omen.
GSR	43G9240	4Mx4(3.3 V)	СМОЅ	W W	· 69	6.0E-09	-		Sign		O)	LaBel, or al, 96/EEE Workship Record, pg 19. Cell and black orners
ESA	4C-MOLIC -IME	4M x 1	СМОЅ	N C N	9		7.	7.4E-14 Ma	May-94		ĸ	Harther-Sarchischi, RADECS97 Data Werdshapp pg. 89: DC 9244
ESA	63F9221 N13226TC	4W x 4	смоз	.M	)XX		उ	<4.8E-19 Au	Aug-94		ž	Harting-Sirensen, RADEC'S97 Data Wirksing, pg. 89. DK'9314. RowKirkmingBark Emen.
ESA	8116100-60P) T32	IoM x I	смоз	FUJ	900		7	2.3E-14 Au	Aug-94		ž	Harthre-Sivenman, RADECS97 Data Wickship, pg. 89. DC 9305
CSFC	BRI 3045FC	128K x 8	СМОЅ	нж	72		-	1 7E-13	966		Đ Đ	LaBel, et al. 971EEE Workship Round, pg. 14. Bu emes.
ESA	D421000C-10	IMAI	СМОЅ	NEC	2019		7	7.3E-13 No	N:v-89		₹	Harbur, Suremen, RADECS97 Data Wirtshap, pg. 89. DrC 8839
ESA	D4216100V-70	IOM x I	смоз	NEC.	300		7	4.7E-14 Au	Aug-94		Ē	Harbur-Surcason, RADECS97 Data Workshap, pg. 89. DrC 9249
CSEC	D42164KKG3-70	4M x 4 (3.3 V)	смоз	NEC	2	2.0E-07		=	566		a)	LaBel, et al, 901EEE Workship Round, pg. 19. Cell enters
ESA	D4241(00V-80)	4M x 1	смоѕ	NEC	005		7	4.1E-13 Ap	Apr.91		SAT	Harbre-Swensen, RADECS97 Data Workship, pg. 89. DrC 9005
ESA	D424256C:80	250K x 4	CMOS	NEC	20.52		×	8 9E-13 No.	Nov-89		ž	Harten-Sireman, RADECS97 Data Wirehaley, pg. 89. DrC 8923
ESA	D424256V-IK)	256K x 4	смоз	NEC.	200		-	1.2E-12 Ap	Apr-9!		SAT	Hartue-Sireman, RADECSV7 Data Wirthship, pg. NY. DIC NV19
ESA	EDI44102C 100ZC	M x I	смоз	EDI	906		7	4.6E-14 Ap	Αρκ-91		SAT	Harbas-Saronson, RADEC'S97 Data Wirkschap, pg. 89 DC'9110
ESA	HMS116148ZK	IOM AI	смоя	HTC	300		e e	3.5E-14 Au	Aug.94		Ē	Hather-Strenkin, RADECSU7 Data Workshop, pg. 89 DKC 9228. Stuck hot se 51 McV.
CSK.	HM511640AJ7	4M x 4	CMOS (5.0 V)	H	6.9	2.0E-07		=	<u> </u>		a D	LaBel, et al, 90/EEE Wirdsalvip Routed, pg. 19. Cell crites
ESA	HMS1164KNZA	1M x 4	смоѕ	нк	300		7	4.0E-14 Aug	Aug-94		Ē	Hartner-Sirrensen, RADECSU7 Data Wirkshipp, pg. 89. DIC 9233. Stark hai er 300 Mev
ES	HM3116St0AS6	4M x 4	CMOS	H	200			1.3E-14 Aug	Aug-94		Ē	Harther-Sareman, RADECS97 Data Warkshap, pg 89 DK 9402. Stack bu ee 100 MeV
ESA	HMS14101ZPx	4M x 1	СМОЅ	Э	300		ě	6.4E-13 May	May-94		2	Harhue-Sayensen, RADECS97 Data Workship, pg. 89 DiC 9010
ESA	HMSIWIGIQUB	4M x 4 (3.3 V)	смоѕ	Ή	=			1.5E-14 19	7.83		<u>x</u>	Hartne-Serenson, et al. SNIEEE Werkship Recentl, pg 74.
ESA	HYB511000A-70	IM X I	смоз	SIE	30%		97	4.0E-13 Non	N:w:K9		₹	Harbuc-Swensen, RADECSV7 Data Workshipp, pg. 89. DKC 8846
ESA	HYB5141000-10	1 M X I	CMOS	SIE	9		2.5	3.5E-13 Apr	Apr.91		SAT	Harbre-Sarensen, RADECS97 Data Wurkahip, pg. 89. Dic (008)
ESA	HYB514256.70	256K x 4	СМОЅ	SIE	200		1.2	1 2E-13 Apr	Apr.91		SAT	Harbie-Sweinsen, RADEC'S97 Daas Werkschep, pg. 89. DKC 9028
ESA	IBM40107080H 5352	7 4 147	СЖОЅ	IBM	002		×	KUE-13 Aug	Aug.94		Ē	Harbie-Streitsch, RADECS97 Data Wirkship, pg. 89. DK-9237. I Bhak Eine e Bunkey
ESA	KM41C160X03.7	16Mail	смоз	SAM	300		7 ×	4.4E-14-	1661		Ē	Harbie-Steinmen, RADEC'S97 Data Werkalbip, pg. 89 - DrC 311

3 3	Device	Function	Technishgy	W	Proton		Bits Bit Tested Xection	L	Test Date	LU, Xsocium	Fig.	Remarks
				1	(MeV)	(cm,)	1	_	$\dagger$	(cm;)	╁	7
ESA	KM41C4001-8	4M x 1	смоѕ	SAM	93		_	7.8E.14 A	Apr.91		SAT	Harbur-Svenson, RADECS97 Data Workshap, pg 89. DrC 019
ESA	KM44V4100AJ	4M 1 4 (3.3 V)	смоз	SAM	2		<u>~</u>	\$ 06-14			ž.	Hartner-Sententian, et al. 98/EEE Workshop Record. pg 74.
ESA	KM44V4100B	4Mx4(33V)	CMOS	SAM	2		7	2.0E-14	7.891		₹.	Harbie-Singmon, of al. 981EEE Workship Roomed, pg 74
CSK	KM4KV8100AS 16	8M x &	CMUS	SAM	6.3			1.0E-14	<u>\$</u>		a <sub>D</sub> n	Label, et al, 971EEE Wintship Recind, pg 14 BK centra.
HON	KM48V8100AS-16	XW x x	CMOS	SAM	ĘĢ.	4.0E-07		_	Jun-98		aon	Ash, et al., 1999 COTS Workship Proceedings, pg 287.
ESA	LUNA ES/3	1M x 4	CMOS	EB.	98		-	3.0E-17 N	Nov-96		CAC	Hartner-Sunzauen, RADECS97 Data Wurtschup, pg. 89. DC name: V <sub>DI)</sub> = 45 V.
ESA	LUNA ES/3	+W14	СМОЅ	B M	28		-	1.9E-16 N	95-AON		CYC	Hartner-Surcencen, RADECS97 Data Workship, pg. 89. DIC mate. V <sub>DI)</sub> = 3.3 V.
CSFC	LUNA-ES Rev C	4M x 4	CMOS/kgn	IBM					7561		Ag.	O'Bryan, et al. 98 EEE Wirkship Rosied, pg 39. Bit, presses & luncumably seconds cries
ESA	MS15100-80J 9A9Z	I x Wt	СМОЅ	O.K.	300		70	8.2E-14	Apr.91		SAT	Hartus-Sarcainan, RADEC'S97 Data Workshap, pg. 89 DC'9010
ESA	MSM44C256P	256K x 4	смоѕ	Ā	20%		~	2.7E-13 N	Nov-89		₹	Hartner-Statement, RADECS97 Data Workshipp, pg. 89. DAC MAD
ESA	MSM4C1000P	1M x 1	CMOS	Σ	50%		-	3.1E-13	Nov-89		PS.	Harther-Streetsen, RADECS97 Data Wirkschipp, pg. 89. DIC 7152E2-12
ESA	MBB14ico 10PSZ	1 WY	СМОЅ	FU	800			1.7E-13	Apr.91		SAT	Harbus-Surcusch, RADECS97 Data Workshipp, pg. 89. DAC 9025
ESA	MCMSI4108/280	†W T	СМОЅ	MOT	XX.		2	2.36-13	Apr.91		SAT	Hartine-Serdunsch, RADEC'S97 Data Werkschey, pg. 89 DC 8951
ESA	MT4C10MC	1 W 1 I	СМОЅ	MCM	900		3	9.18-14	Apr-91		SAT	Harhic-Sirdnen, RADECS97 Data Wirkship, pg. 89. DIC 9102
ESA	MT4C4kbl D02A	4M x 1	СМОЅ	MCM	99		-	7.3E-14 N	May-94		₹.	Harther-Surginger, RADEC'S97 Data Workshop, pg. 89 DC 9236C
E	MT4CM4BIDW	1M 1 4	СМОЅ	Z Z	900			3.1E-14 A	Aug.94		ž	Hartic-Sircinga, RADEC'S97 Data Workship, pg 89. DIC 94008
ESA	MT4LC4001 D22	₩ ¥	CMOS	MCM	300		~	2.1E-14	tr-any		2	Hartic-Sirences, RADEC'Sy7 Data Wirkship, pg 89. DiC nate. 200-800 McV 1 Rive Erre
ESA	MT4LC4M4B1D1.6	4M x 4 (3 3 V)	CMOS	MCN	=		-	1.56-14	7.64.1		₹	Harther-Sardenschi, et al. Wileee Workship Regional, pg 74.
ESA	MT4LC4M4EXTG	4M ( 4 ( 3 3 V )	CMOS	Z Z	=			X 0E-15	1997		Ē	Harbie-Sorgingh, et al. 981EEE Workship Record, pg 74.
ESA	MT4LC4MBID2KM	+W 1 4	смоя	MCN	8			2.7E-15 P	N:14-46		сус	C. Harthus-Simonau, RADEC'S97 Data Workshop, pg. 89. DK inne. V <sub>D11</sub> = 4.5 V.
ESA	MT4LC4MB1D2kM	- TW Y +	смоя	MC N	Ê			4.9E-15	Nov-96		CYC	☐ Harhine-Sintolium, RADEC'Sv7 Data Workship, pg 89. DKC mins. V <sub>DD</sub> = 3.3 V.
CSEC	MTSC1880CW-25	12KK x 8 (5 0 V)	CMOS	WC.	63			4.8E-17	986		CCD	D Label et al. 971EEE Workshop Rosinal, pg. 14. Bit centra
CSK.	SMIHIO	4M X 16 EDO (5 0 V)	CMOS/cps	χ̈́	\$			3 5E-13	1992		SAT	T Duzellier, et al. 93/EEE TNS propriet (net published). DK ES. Also has protein class.
ESA	SM14C1024-12JDM	IM x I	CMOS	Χ̈́L	402		7	4.7E-13	Nov-89		₹	Hartner-Siverassen, RADEC'S97 Data Wirekshipp, pg 899 DAC 88440
ESA	SMX44100-WOHLM	4M x 1	СМОЅ	¥	900			2.6E-13 N	May-94		æ	Harbac-Sarcascan, RADECS97 Data Workshop, pg. 89 DAC 9218 B
ESA	TC511000AP-10	IM 1	смоѕ	TOS	30%			3.78-13	Nov-K9		ž.	Harbuc-Surensen, RADEC'S97 Data Wirthship, pg. 89 DK' 8748
ESA	TC51164001-60	1 W 1 1	СМОЅ	TOS	300		_	1 66-13	Aug94		ž.	Hathre-Swormen, RADEC'S97 Data Workship, pg. 89 D/C'9334MCD
ESA	TC514100Z-10 HDK	17 W\$	смоз	TOS	900			2.3E-13 ,	Apr-91		\$	SAT Harbur-Sergiusch, RADECS97 Data Workshipp, pg. 89 DIC 9007

[7]					Pretan	Device	Bits	Bu	Tost	3	F	
, and	Device	Fusking	Technology	Mir	Energy (MeV)	Xxxxivan (cm²)	Tested   Xaxtum   (cm²)		Date LUis	- <del>-</del> -		Remarks 8- Jun-99
FSA	TC514256F-10	250K x 4	СМОЅ	TOS	209		9.8	3.9E-13 Nov	Nov-89		<u>8</u>	Harbue-Sarcascan, RADECS97 Data Workshap, pg. 89. DrC 8811
ESA	TMS4164KDA	7 × M7	смоѕ	Χ̈́L	300		3.7	3.7E-14 Aug	Aug-94		₹.	Harbus-Surgisson, RADECS97 Data Workshipp, pg. 89. DAC ment.
CSK.	TMS416-400DJ-60	1 × Wt	СМОЅ	ΧIT	197		5.4	5.45-12	986		IUCF	Label, et al, 971EEE Workship Round, pg 14. Bu orners.
ESA	TMS44100DM-80	4M x 1	смоѕ	ΧIT	900		2.2	2.2E-13 Apr	Apr.91		SAT	Harber-Sergman, RADECS97 Data Workship, pg. 89. DC 0485
ESA	TMS4416-12NL	10K x 4	СМОЅ	XIT	309			1 4E-12 Nav	N:v-89		ž	Harbus-Sendings, RADECS97 Data Werkship, pg. 89. DKC 8844
CSH.	TPOLISHOUALIBE-70	T W T	CMOS	IBM	. 50	6.0E-09			585		CON	Label, et al. WIEEE Workship Record, pg 19. Bit errors and one block error
100 mg		Micrograsser (32-bk)			9	- **	- 1		- 33	- ,		- 30
SEI	MUMMODXZRP				દ			7881	۲۵		CD	
<u> </u>	KS-PRIMABX	Pathun	CMUS (3.5 V)	AMD	561			74-ml	. L.	5.6E-09	PS IUCF	
ેર્ડ જ			The state of the s	*					. « <b>*</b> _			
CSK	62123	Optioniples		MPC.	*			7481	56		ELL.	<u> </u>
GSFC	certitists	Optionsylps		MPC	6			7661	76		aco	OBryan, et al. 98[EEE Wirkship Resurd, pg 39. No SETs observed.
GSFC	ONLINA	Openingles		MPC	28			7661			2	O'Bryan, et al. 98/EEE Wirkship Recard, pg 39. No SETs indectived
GSFC.	*TNT	Орыслирыя		огт	63			7991	20		aco	O'Bryan, et al, VBIEEE Winkship Record, pg 39. No SETs inharroal
CSK	<b>プラス</b> マ	Ористирка		MRC	88			7441	5		星	O'Bryan, et al. 98/EEE Workshop Record, pg 39. No SETs or CTR degradation
CSEC	4N55	Opinicumples		нРА	2			7561			nco	O'Bryan, et al, 9NIEEE Workshipp Recurd, pg 39. No SETS observed
GSK	ok I Na	Optionsupples		MPC	ξė			7441	7.6		g S	OBIYAR, CI BI, WALEEE WARNING RECEITAL PR 39 DK 9707 No SETA characted of 45 V and has
CSH.	in INC	Валиция Априла	700 µm (GaAsP) sandwich	MR	*			7.9%I	-20		2	O'Bryan, et al. VRIEEE Weatchey Record, pg 39. No SETs observed.
CSK.	SN140A	Darturgum Amphilics	700 µm (GaAsP) xandwich	HPA	Ę.			7581	7.6		BNL	O'Bryan, et al. 981EEE Wintschip Recinid, pg 39, DIC 9707, No SETs utherneal
CSH	HCPL S401	Оримпирка		Ξ Δ	ē	x SE-08		7.83	τ.		aon	O'Bryan, et al. WIEEE Winkship Record, pg. 39-20-25 in SETs (thective) with daying unhanced
GSK	HCPL-5631	Hi-Cam Amp	700 µm (GaAsP) sandwich	HPA	63	3 SE-UK		7.82	n n		e)n	Label et al. 971EEE TNS, Vol. 44, No. n. pg 1885 DCV23.7 & 9707
GSK	HCPL-5631	Hi-Gam Amp	700 µm (GaAsP) sandwich	HPA	38.2	4.5E-08		7661	71		CD	LaBel et al. 971EEE TNS, Val. 44, No. 6, pg 1885 DK9347 & 9707.
GSK	HCPL-5631 (6N134)	Н-Сам Апр	700 µm (GaAsP) sandwich	HPA A	Vaf.			7661	r,			O'Bryan, et al. WIEEE Wirthship Rusnel, pg 19 SETs abusined
CSH.	HCPL-ms1	Optionship		HP.	220	1 0E-0%		7861	LI LI		12	O'Bryan, et al. 9NIEEE Wirthship Record, pg 39. SETs inhurred.
SK.	HCPL-mst	Opticioniples		нРА	92	1.0E-07		7 <del>.2</del> 41	<i>u</i>		ICUF	OBIYAR, CLAI, SHIEEE Winkship Recircl, pg 39. SETs inhurved. NinCTR degradami. Crima sections of SVP.
CSK	HCPL-en51	Optimingples		HPA	*	1.0E-07		7661	r,		TR	OBryan, et al. WHEEE WARAKHY Record, pg. 39. No SETs or CTR degradation with active or passive filters. SETs but no CTR degradation without filters.
CSK.	HSSR-7110	Riwa MOSFET Opticingles	AKGAN LED, n-chaund MOSFET	Ϋ́	ž							LaBel, et al. EEELinks, Vol. 3, No. 1, pg. 5, Mar 1997. No. SEE
CSFC	SEDA	1773 IMHz F/O Bus		SCI	69		-	7.89	<i>u</i>		a)n	O'Bryan, et al. VRIEEE Workshop Roomed. pg 39. Printing-inclused SEUs
		P Company				5.14		-2-	-4-	_1,	-	
- 1		(Nasu	Bipalar	SC	200	3.2E-11	-	FSP-56	ş	_	EQ.	Transients rely. +25mV input delta

	kw-mit-8																	
	Remarks	Transients only: +25mV mpat delta.		DI - EDI Curp. FOR - Fires, lik.	- ISS, Inc. MAT - Matsushita:	nal Schnichthicher;	nelectronics Center:				The second special second special second special second special second special second		The state of the s		The state of the s			
L	T.	IUCF		as Corp. El	Comp. ISS	ISC - Nates	Hogies Mica	ļ			L NY	-					×	
3	LU <sub>th</sub> Xsoction (cm²)			TYP · Cypte	SM - funas	Tric Corp. N	ntod Tochik				BNL - Tankm Van de Graalf, Breikhaven National Laberatones, Long Island, NY	CYC - CYCLONE, Université Catholique de Louvain-la-Neuve, Belgium				1. Canada	UCD - University of California at Davis, Crucker Nuclear Laboratory, Davis, CA	
_		۽	-	Telegraph: (	intel Corp. I	VIPPANI EAC	U-MTV	_			thurstones,	wel-la-Neuv	Enn. IN		-	th Columbia	ar Laburate	_
Text		Fch-96		lephyne & 7	J- LINI - I	rp: NEC - N	S - Truthiha				National La	de Louva	, Вкиппу	criand	_	wva. Brills	reker Nucle	larwell, UK
Вн	ted Xscette			merican Tel	ce Technolo	icnipac, Cu	uncarts, TO				nxikhaven	Catholique	trun Facility	ligen. Switz	France	thity, Vance	I Davis, Cn	11, AERE, I
Device Bits	Xsection   Tested   Xsection (cm²)   (cm²)	1.2E-10		K: ATT - A	grated Devi-	S. MPC - M	Texas Instru				de Graall, B	Université	IUCF - Indiana University Cyclotem Facility, Bloxenington, IN	PSI - Paul Scheerer Institute, Villigen, Switzerland	SAT - SATURNE, CEA, Saciay, France	TRI - TRI-University Mesen Facility, Vancouver, British Columbia, Canada	Cadifornia a	VEC - Variable Energy Cycleterer, AERE, Harwell, UK
-				od Signad, 41	IDT - Inke	tor Product	Corp. TIX -		Kadiation Facilities:		ucken Van	YCLONE,	diana Unive	1 Schooner I.	TURNE, C	1. University	nversity of	viable Ener
Рими	Energy (McV)	()()2		ASI - Allin	s Machines	Semiconduc	NY - Sony t		Kadiathn		BNL . Ta	CYC.C	IUCF - In	PSI - Pau.	SAT - SA	TRI - TRI	UCD . UI	VEC - Va
	Mir	NSC		wices Curp	nal Busines	Minima	costs, Inc.; SI			_								
	Толинову	Bipolar		XVRCS, AMD - Advanced Microk	TC - Huachi, Ltd. IBM - Internation	(France); MIT - Mitsubishi, MOT -	Santaung: SIE - Sicricias Composi-											
	Factor	()		Manufactures: ACT - ACTEL, Cop. ADA - Advanced Analog Devices. AMD - Advanced Manushives Corp. ASI - Alhed Signal Inc. ATT - American Telephone & Telegraph. CVP - Cyness. Corp. EDI - EDI Corp. FOR - Free, Inc.	FUL PHINE, Ld. HAR. Harm, Cop. HPA - Rewich Packard, HTC - Hitachi, Ld. IBM - International Business Machines, IDT - Integrated Device Technology; INT - Intel Cop. ISM - Interna, Corp. ISS - ISS, Inc. MAT. Marsachita.	MCN - Marin Toliningua: MHS - Marin-Harin Someondarie (France): MIT - Misababi. MOT - Monecela Someondarie Peddads: MPC - Menyas, Crept NEC - Night Exerts Crept NSC - Marinal Someondarie;	PFS Portermance Science and Condense (VI) - Quadamental, Inc. SAM - Sainbang; SIE - Skeiners Comprehense, Inc.; SNY - Sony Corp. TIX - Texas Insumments. TOS - Traching, UTM - United Technologies Magneteentumes Context				Contar, Grounhelt, MD	cy. Neuralwife, Neitherlands	Jenns, Chearwater, Fl.	rry, Pasakora, CA	France	ics AB, Luikopang, Swoden	San Diego, CA	
	Device	6EIWT		Manufacturers: ACT - ACT	FUJ Fujitsu, Ltd. HAR - Haz	MCN Marin Techniques.	PFS - Performance Schweinick		Test Houses		USFC - Gradual Space Flight Center, Greenhelt, MD	ESA = European Space Agency, Norschripk, Nethratanks	HON = Huncywell Space Systems, Cherwaler, FL	JPL = Jet Propulsons Laboratory, Pasadena, CA	MMS - Matra Marcinis Spare, France	SAAB - Eresson Saab Avenues AB, Luikepung, Sworken	SEL - Space Electronics, Inc., San Diego, CA	
10	, Aro	Ή	1 egend:		<u> </u>								-		1		:-	

Tex	Device	Finaction	Toechardons		Proton			L.	-	<b>-</b>	<u> </u>	
			(9)(10)(10)	Ē	(MeV)	(cm²)	lested Asection (µm²)		Date LU <sub>IN</sub>	Xsection (cm²)	Fac	Remarks 26-Apr-99
GSF	GSEC DAC 08	1. S. J.	Riccian	Ā	;;							
			modic	Ψ <u>Ψ</u>	8		+	2	156		g	O'Bryan, et al 981EEE Writshp Rec., pg 39. I <sub>ti</sub> & I <sub>ref</sub> out of spec & 30krads.
3	GSK DAC 08		Bipolar	RAY	59			91	7661		UCD	O'Bryan, et al 981EEE Writshp Rec., pg 39. No parameters out of spec & 30 krads.
GSF	GSFC MHF+2805S	Single output, +5 V	Hybrid	VQV	15			5	1661		E E	OBryan, et al 981EEE Writship Rec., pg 39. DVC 9616. Ceased regulating @ 4.4E10 pkm² (-7
GSF	GSPC MHF+2812D	3-Output, +5 V, +12 V.	Нукіл	VDΑ	51			5.	7661		LLU	OBryan, et al 98IEEE Writshp Rec., pg 39. D/C 9613. Ceased regulating @ 4.4E10 pkm² (-7 krafs).
GSR	GSFC 62123	Optocoupler		MPC	58			1661	16		훋	O'Bryan, et al. 981EEE Writshp Rec., pg 39. Shows CTR degradation and some SETs.
GSP	GSPC 66088	Optucoupler		M N	69.			7 <b>2</b> 61	5	ļ	g	O'Bryan, et al. 981EEE Writshp Rec., pg 39. No CTR degradation or SETs.
GSP	GSFC 660999	Optocoupler		MPC	58			1661	5		崖	O'Bryan, et al. 981EEE Writshp Rec., pg 39. No CTR degradation or SETs.
GSR	OSPC 4N49	Ориссиріег		MPC	88			15661	5		Ē	O'Bryan, et al. 981EEE Writshp Rec., pg 39. No CTR degradation or SETs.
GSR	GSFC HCPL-6651	Optocoupler		ΗF	220	1.0E-08		1997	74		星	O'Bryan, et al, 981EEE Writshp Rec., pg 39. No CTR degradation. SETs observed.
SR	GSPC HCPL-6651	Optucoupler		HPA	52	1.0E-07	-	7661	"		ICUF	OBryan, et al. 98IEEE Witship Rec., pg 39. No CTR degradation. SETs observed. Cross section de tare
SR	GSFC HCPL-6651	Optoxoupler		HPA	85	1.0E-07		1997	2		Ĭ.	O'Bryan, et al, 981EEE Wrishp Rec., pg 39. No CTR degradation or SETs with active or passive filters. SETs has no CTR degradation with no files
GSR	GSFC P2824	Optacoupler		НАМ	\$1.8		-	F9951			E	OByan, et al. 98/EEE Witshp Roc., pg 39. CTR degraded below specification with drive current < 7.2 mA at 6E10 pcm.
GSR	GSFC P2824	Optocoupler		НАМ	195			7991	7.		IUCF	OBryan, et al, 98IEEE Wirkshp Rec., pg 39. CTR degraded below specification for all drive currents (max. 12.1 mA) at ~1.5E11 p/cm <sup>2</sup> .
SSR	GSFC PFORX12	Data Transmission Receiver		NO	62.5			1997	7		COn	OBryan, et al., 98IEEE Writshp Rec., pg 39. No bit errors up to 30 krads. Error bursts at 85 krads.
CSK	GSK: PFOTX12	Data Transmission Xmtr		ONI	62.5			7661	7		UCD	O'Bryan, et al, 98IEEE Wrkshp Rec., pg 39. No bit errors up to 30 kmals. Error bursis au 85 krads.
GSR	GSFC REF-43	2.5 V Reference.	Bipolar	IQV	VAE.			1999	4		Val.	O'Bryan, et al. 98IEEE Wrkshp Rec., pg 39. V <sub>ref</sub> aensitivity @ 30-30 krada.
- Perend	ij											
	Manufacturers: ADA - Adva	need Analog Devices; ADI - Analog	Manufactures: ADA - Advanced Analog Devices, Dr.: HAM - Hamamatur; HPA - Hewley-Parkard; MPC - Micropac Conn. ONI - Original National Nati	Hewle	t-Packard: MP	C - Micropac	INO.	S S S S S S S S S S S S S S S S S S S	lumber Inc.	I P		is leanly mass
1	Ted House.										Town III	III., III., KAN I - KAYUKUN
1	GSFC - Guddard Space Flight Center, Greenbelt, MD	M Center, Greenbelt, MD			Cadintion Fac	Radiation Facilities:	Lyton Facility	100	1			
					LU - Loma Li	nda University	Medical Ce	ny, paodim	Linda, CA			
					RI - TRI-Univ	TRI - TRI-University Meson Facility (TRIUMF), Vancouver, British Columbia, Canada	cility (TRI	UMF), Van	couver, Briti	sh Columbia	Canada	
				1	JCD - Univers	ty of California	at Davis, C	rocker Nuc	lear Laborate	ry, Davis, C		
				$\prod$			+	$\frac{1}{1}$				
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